#2

FARM MACHINERY INDUSTRY AND FARM SAFETY

THE FARM MACHINERY INDUSTRY IN ONTARIO AND COMMENTARY ON SOME ASPECTS OF FARM EQUIPMENT RELATIVE TO FARM SAFETY

A BACKGROUND PAPER PREPARED
BY
THE ONTARIO CENTRE FOR
FARM MACHINERY AND FOOD PROCESSING TECHNOLOGY
CHATHAM, ONTARIO

FOR
THE ONTARIO TASK FORCE ON HEALTH AND SAFETY IN AGRICULTURE
434 UNIVERSITY AVENUE
TORONTO, ONTARIO M7A 1T7

SEPTEMBER 1984

FARM MACHINERY INDUSTRY AND FARM SAFETY

THE FARM MACHINERY INDUSTRY IN ONTARIO AND COMMENTARY ON SOME ASPECTS OF FARM EQUIPMENT RELATIVE TO FARM SAFETY

A BACKGROUND PAPER PREPARED
BY
THE ONTARIO CENTRE FOR
FARM MACHINERY AND FOOD PROCESSING TECHNOLOGY
CHATHAM, ONTARIO

FOR
THE ONTARIO TASK FORCE ON HEALTH AND SAFETY IN AGRICULTURE
434 UNIVERSITY AVENUE
TORONTO, ONTARIO M7A 1T7

SEPTEMBER 1984

CONTENTS

Page

Page

Page

EXECUTIVE SUMMARY

The purpose of this background paper is to present a qualitative and descriptive picture of the farm machinery industry in Ontario, with particular emphasis on Ontario manufacturers. Also identified and reviewed are the mechanisms that are in place to advise farmers on health and safety protection measures, with comments on their apparent strengths, weaknesses and effectiveness. Qualitative (as opposed to statistical) and impressionistic safety hazardousness ratings of the hazards of the various pieces of farm equipment have been summarized in Chapter Four. Since that is already a summary, it will not be further summarized here.

In the normal course of their business, when farm machinery manufacturers embark on their product development/production/marketing cycle, they must first define who their market is, recognizably the farmers and the farming companies. While the farmer is the focal point of the machinery manufacturer's ultimate sales effort, the business of farming involves many more individuals and organizations. These individuals and organizations all work in the same way without competition with each other, but with a fair degree of co-ordination and information exchange towards a primary goal, which may be summarized as attaining greater agricultural production with better quality and better economics. Members of this group include, among others, the OMAF offices, agricultural representatives, field engineers, the University of Guelph, the agricultural colleges, federal and provincial research institutes, the farmer and a host of farming-related associations, and, as a group, may be referred to as the "Agricultural Fraternity".

The farm machinery manufacturers are <u>not</u> natural members of the fraternity. Their primary goals, instead, are to attain an attractive net return for their shareholders. While the members of the agricultural fraternity work together and willingly share information, particularly as it relates to their common cause, the individual farm machinery manufacturers do not. In fact, they generally work alone and against each other. Because of this competition, they maintain confidentiality about their business operation and operate without co-ordination with each other. In contrast to the agricultural fraternity, there are no machinery industry representatives, field engineers, or research centres to serve the farm machinery industry. This confidentiality, lack of information exchange, or co-ordination may be seen as a principal reason why many Ontario machinery manufacturers have not kept pace with technology that is available, and why many have not grown beyond their local markets.

One hundred and thirty Ontario farm machinery manufacturers have been identified in Ontario and are listed in Chapter Three. Categorized according to size, eighty-seven have been identified as small manufacturers, thirty-seven as medium-sized manufacturers, and six as large manufacturers. The highest concentration of manufacturers is in the Kitchener-Waterloo region, followed by the London, St. Thomas, Tillsonburg, and Simcoe areas.

In terms of capability, large manufacturers have engineering departments composed of trained professionals who have access to the latest equipment and technology such as computers, CAD (Computer-Aided-Design) and information systems. There is a significant involvement in research, development and testing. High volume production is aided by the use of CAM (Computer-Aided-Manufacturing) robots, etc. Their product is marketed through dealer networks and they typically provide dealer training in the proper maintenance, servicing procedures and parts supply programmes for their equipment. There appears to be little direct communication by large manufacturers with individual farmers.

In comparison, medium manufacturers have engineering departments with trained professionals, but these are not as elaborate as those of the large companies. Research is not a typical activity of medium manufacturers, and instead, they often purchase their technology or rely on information from other researchers, universities, colleges and government centres. Typically, their manufacturing facilities are fairly up-to-date. Medium manufacturers also sell through dealer networks, but rarely do dealers represent only products from one medium manufacturer. Consequently, medium manufacturers often compete with all other manufacturers represented by these dealers. Medium manufacturers often contact individual farmers to evaluate the performance of new products which are sometimes loaned to the farmers.

Small manufacturers generally operate on an owner-operator basis with little or no professional engineering involvement in the design and production of their products. They seldom carry out extensive market research and very rarely conduct technical research. Consequently, most operate with a somewhat limited focus. Small manufacturers usually do not have communication with technical information centres or universities. Most have low volume, batch-type, production requirements and arrangements which seldom justify the investment required to introduce high technology, high productivity, production systems. Since they typically service a limited

geographical area, they are able to offer direct sales on a personal basis and sometimes provide customized units to individual farmers or groups.

Machinery found on Ontario farms comes from a wide variety of sources, but principally from Ontario manufacturers, Western Canadian manufacturers, from the United States, Japan, and from a variety of European countries. In fact, much more than half of the machinery used is produced outside Ontario.

Generally, the priorities of manufacturers relate to producing and selling the largest possible volumes of similar items of equipment whose design and production is based on the "least that will do the job adequately". Dealers' and distributors' priorities relate to the volume of products sold and margins of profit. They try to acquire product lines that are compatible and will sell in the markets in which they normally operate. Farmer or user priorities appear to relate to maximizing the production of quality products at the least cost.

There are numerous organizations and associations involved in various aspects of the farm machinery industry. There are those that speak for or represent specific segments of the industry and those that try to serve the industry. However, no single organization represents all or a majority of the Ontario or Canadian farm machinery manufacturers as manufacturers. It is perhaps this non-representation that is one of the weak links of the Ontario farm machinery industry. There is no apparent means for a government or other body to speak to that group as an industry and no visible means for that group to gather and voice its collective needs and interests.

There are a number of organizations in the Agribusiness that have an interest in safety as it relates to their specific fields. However, there appears to be only one organization in Ontario whose principal concern is health and safety relating to farmers, the Farm Safety Association (FSA). The principal activities of the FSA and its sub-associations are concerned with awareness and education relative to farm safety. The FSA is obviously a well-intentioned group, but it would appear that it is not as effective as it might be in promoting safety and influencing the majority of farm machinery manufacturers. This appears to stem from four basic reasons, none of them deficiencies of the FSA: namely, difficulty of dialogue with Ontario farm machinery manufacturers, since there is no single voice representing all or a majority of these manufacturers; the apparent lack of an authority to ensure adoption of safety design standards by manufacturers; the lack of an authority to ensure that manufacturers correct apparent safety deficiencies in their

equipment designs, and the apparent lack of an ability to apply penalties to farmers with excessive accident frequencies.

In summary, the FSA is advising farmers on matters which seem to be less than that group's top priority. Further, it would seem that the FSA requires better communication with the farm machinery industry, and the farm machinery industry, in turn, needs encouragement and/or incentive to enhance its priority of safety in farm machinery design.

CHAPTER ONE

BACKGROUND

Introduction

The following background paper relative to the Farm Machinery Industry in Ontario, and to certain aspects of farm equipment was prepared in response to a request from Dr. N. R. Richards, Chairman of the Ontario Task Force on Health and Safety in Agriculture and its members at a review meeting February 17, 1984.

Terms of Reference

The Terms of Reference for the Task Force are included here as supportive preamble to the Terms of Reference for this background paper. The Terms of Reference for this paper as developed by the Ontario Centre for Farm Machinery and Food Processing Technology and the Task Force follow those of the Task Force in this chapter.

Terms of Reference for the Task Force on Health and Safety in Agriculture

1. The Task Force is established by the Minister of Agriculture and Food and the Minister of Labour of the Province of Ontario and its members will be appointed by documents signed by both Ministers.

2. The Task Force is constituted to carry out the task defined in these Terms of Reference and will cease to exist when that task is completed.

3. The function of the Task Force will be to investigate and report on the need for protection of the health and safety of farmers, farm workers and members of farm families engaged in farm work. Among the matters the Task Force will consider are:

   (a) the nature of occupational health and safety hazards in agriculture;
   (b) where the need for protection exists, that is, what occupations, farm work activities and types of farming;

(c) how the occupational health and safety experiences of persons engaged in on-farm work vary by age, form of attachment to the industry, length of service and other relevant personal variables;

(d) the problems of defining a farming operation and a farm workplace;

(e) mechanisms for providing protection against health and safety hazards in farm work; and

(f) if the conclusion is that legislation is required, the areas to be addressed.

4. The Task Force will present its findings to the Ministers of Agriculture and Food and of Labour, in a fully documented final report and, as deemed appropriate, interim reports will be made to a joint steering committee of officials drawn from both Ministries.

5. The study will be initiated in October, 1983, and every reasonable effort will be made to make the final report available during July 1985.

6. The Task Force will obtain information necessary to its assignment through library research, receipt of presentations from farmers and others interested, and consultation with persons who are knowledgeable about farm health and safety in Ontario and other jurisdictions. The Ministries will provide research resources to assemble, analyze and document information required by the Task Force.

REVISED
TERMS OF REFERENCE
FOR
A BACKGROUND PAPER DESCRIBING THE INDUSTRY SUPPLYING FARM MACHINERY IN ONTARIO AND IDENTIFYING THE SAFETY HAZARDOUSNESS OF FARM MACHINERY.

The paper will cover the matters set out below.

1. Present a qualitative and descriptive picture of the industry supplying farm machinery in Ontario with particular emphasis on Ontario manufacturers. The picture will provide a profile of the industry as well as a profile of its, "typical", representative companies. Also included will be an identification of the agricultural industry that is served by the machinery industry and its relationship with that industry. The description will include the Centre's findings on the communications links between the machinery industry and farmers and their inputs concerning machinery design, features and needs.

2. Present a qualitative (as opposed to statistical) and impressionistic safety hazardousness rating, and an identification of the hazards of the various pieces of farm equipment. The ratings will be assigned from the equipment design, configuration and construction point of view, as opposed to the experience and use point of view. This rating will be made for equipment which is specialized to the various type of farming carried on in Ontario and for the common denominator equipment which generally spans agriculture, for example, tractors. The goal of these ratings will be to help identify those types of machines and types of farming that are most dangerous or hazardous due to the complexities or other characteristics of the machinery used.

   The ratings will not only cover the operating and use characteristics of the machinery, but also, those relating to service and maintenance.

3. The ratings made will cover the categories of farm machinery as follows:

   - working and fertilizing the soil;
   - planting, cultivating and harvesting crops;
   - preparing and applying farm chemicals;
   - storing, handling and preparing and distributing feed.

4. With respect to farm machinery and equipment, identify and review the mechanisms that are in place to advise farmers on health and safety protection measures, and to comment on their apparent strengths and weaknesses, and on how effective they are.

5. The report is intended to be as comprehensive as the agreed approach to the task permits.

N. R. Richards, Chairman
Ontario Task Force on
Health and Safety in Agriculture

G. B. Fossenier, President
Ontario Centre for Farm
Machinery and Food
Processing Technology

June 13, 1984.

The Ontario Technology Centre and the Background Paper

This background paper has been prepared by the Ontario Centre for Farm Machinery and Food Processing Technology, located in Chatham, Ontario.

This Centre, opened in February, 1983, under the sponsorship of the Board of Industrial Leadership and Development (BILD) and the joint efforts of the Ontario Ministry of Industry and Trade, and the Ontario Ministry of Agriculture and Food, has a mandate to help the Farm Machinery and Food Processing industries with the introduction of technology into their operations. The emphasis is to work mainly with the medium and small manufacturers and processors since, in most cases, the larger companies have their own in-house technical capabilities.

Relative to Farm Machinery, the Centre's mandate might be paraphrased more specifically as "providing information, advice, and project handling services relative to:

- the engineering and design of new equipment;
- the modification and adaptation of existing equipment to suit Ontario's conditions;
- the development and evaluation of prototype machinery; and
- manufacturing methods, layouts and productivity improvement."

The Centre's staff, at this writing numbered in the mid-twenties, has been drawn from various technical, educational, research, and industrial organizations related to the industries it serves.

The professional staff who has provided input to this background paper represent many years of technical experience in the design, development, analysis, testing and manufacturing of farm machinery. In addition, some of these professionals have spent considerable time employed in senior technical positions with Ontario's farm machinery manufacturers; small, medium and large.

On September 21, 1983, after the Centre had recruited a suitably qualified, and experienced technical staff, it was granted a certificate and permission to function as a consulting engineering firm by the Association of Professional Engineers of Ontario (APEO).

It is with this interest, mandate, and qualification that the Centre has accepted the challenge of trying to present a qualitative "picture" of the farm machinery industry for the Task Force.

As in any such endeavour, it is difficult to present the various facets of the "picture" with the same degree of emphasis and detail that its various readers may expect. Further, it is difficult not to unwittingly overlook some segments that should originally have been included. To the extent that such things can be overcome, or corrected by follow-up questions, the Centre would be happy to provide clarifying additional information to such requests.

An important request by the Task Force was to provide a subjective and impressionistic rating of the hazardousness of various pieces of farm equipment, as well as a definition of the hazard. Clearly, that is an assignment which is not too difficult to perform, but is one that is extremely difficult to do well. Subjective judgements are often necessary when many of the factors seem fuzzy, poorly defined, of questionable application, and take on different meaning in different circumstances. What has been provided is a "best attempt", while noting that it was done by a group of senior people, presumably unbiased, and with a good deal of familiarity with the industry. Again, it is without demeaning intent, if some types or pieces of equipment have been overlooked, or if the relative ratings appear to deal more harshly or otherwise with some pieces of equipment than with others.

To reiterate, the purpose of the paper is to present a "picture", and the Centre's motives have been only to do just that, as part of its mandate to assist the agribusiness industry.

Finally, a note of acknowledgement and thanks to the broad cross section of Ontario farmers, equipment dealers and manufacturers, as well as the various organizations and associations which serve or are part of the machinery industry, for their assistance. Many were visited, or interviewed, and others permitted the Centre's staff to examine their equipment, their literature, and their facilities. Without their assistance, this report, and the "picture", would be much less comprehensive and meaningful.

A Profile of the Agriculture Fraternity and the Farmer

In the normal course of their business, when farm machinery manufacturers embark on their product development/production/marketing cycle, they must first define who their

market is, recognizably the farmers and the farming companies, and they must identify the needs of the market which they are trying to serve. Simplistically, it may seem that their answers could be arrived at by simply talking to a wide range of farmers and farming companies. Realistically however, one soon discovers that while the farmer is the focal point of the machinery manufacturers ultimate sales effort, the business of farming involves many more individuals and organizations who are concerned not only with the farmer's concerns, but with the much broader aspects of agriculture in Ontario and Canada. This much wider group of individuals and organizations, including the farmers, are working in various aspects and endeavours towards the common goals of the agricultural community. Those goals can be defined and described in a number of ways, but they can probably be collectively summarized as "attaining greater agricultural production with better quality and better economics".

Because there is this community of people working together in a variety of ways, with perhaps some degree of rivalry, but little actual competition, towards a common interest or goal, they might well be perceived by those outside the group, and particularly by the machinery manufacturers, as being a fraternity or club. This fraternity, one might call it the agricultural fraternity, collectively and through its individual members and their daily and routine efforts, addresses the needs and problems of the agricultural industry and as an outgrowth of its own purpose, in fact, define the market opportunitites for the farm machinery manufacturers.

It is possible to conclude, therefore, that the farm machinery manufacturers serve a market as defined by the agricultural fraternity. If machinery manufacturers are to have a clear picture of their market and a knowledge of the direction in which it is unfolding, it is apparent that they must monitor and have close and continuing dialogue with the agricultural fraternity.

Informal, and perhaps undefined, membership in the agricultural fraternity is broadly based. While acknowledging that some significant member groups may have been unintentionally overlooked, its membership includes the following:

(a) farmers and their families;
(b) farming companies;
(c) University of Guelph;
(d) the Ontario regional agricultural colleges: Ridgetown, Alfred, Centralia, Kemptville, New Liskeard;

(e) Ontario Ministry of Agriculture and Food (OMAF), its administrative, technology, marketing and development offices as well as its regional offices and including the agricultural representatives, the agricultural engineers, the economics specialists, the provincial agricultural research stations, the Farm Machinery Board, and the Agricultural Research Institute of Ontario;
(f) Agriculture Canada and its research stations, its administrative and technical offices;
(g) the Farm Safety Association;
(h) a host of agricultural and farmer related associations.

Again, they all work in some way without competition with each other, but with a fair degree of co-ordination towards a primary goal to "attain greater agricultural production with better quality and better economics".

The farm machinery manufacturers are not natural members of this fraternity. Their primary goals are different. Their ultimate purpose is other than to "attain greater agricultural production with better quality and better economics". It is, instead, to attain an attractive net return for their shareholders and they strive to do that by serving those who would "attain greater agricultural production with better quality and better economics". The focal point toward their primary purpose is their ultimate customer, the farmer, the individual or company who is actually engaged in the production in which the rest of the fraternity is interested and involved.

While the members of the agricultural fraternity work together, the individual farm machinery manufacturers do not. In fact, they generally work alone and against each other. Because the machinery manufacturers are in competition with each other, they also maintain confidentiality about their business operations. To do otherwise may permit a competitor to gain an edge which ultimately could lead to a sales or product advantage. That advantage to one company, in a competitive world, must ultimately be to the disadvantage of some other. The type of information that is usually coveted relates to financial results, product development, sales trends, market share, pricing, product problems, personnel, litigation, tax treatment and the host of factors that affect operating results and the future strength of a company or product line.

In contrast to this type of secrecy, the agricultural fraternity willingly shares its information, and particularly as it relates to their common cause. It is perhaps through this contrast in information sharing that one might get a clearer definition of the makeup

or membership of the agricultural fraternity. Certainly individual farmers share their daily farming concerns with other farmers and with the Ontario Ministry of Agriculture and Food agricultural representatives and research organization members who are involved in agriculture. It follows that the various Ontario Ministry of Agriculture and Food and Agriculture Canada departments and offices, as well as the various colleges and universities are also there to serve with a particular mandate. Their information is readily available and is exchanged and promoted accordingly.

Not only is such agricultural information shared, it is usually free of charge to those wanting it, being ultimately paid for through taxes or indirectly through association memberships.

This same agricultural information is similarily available to the machinery manufacturing companies. Those companies that have the resources to wisely and productively use this information can create their own competitive advantage related to product development, and ultimately to serve their market, the farmers.

The industrial information required to become a more capable or more competitive machinery manufacturer is usually not free, however, neither are the technical services required to develop and market new machinery products. There are, as an example, no machinery industry representatives, field engineers or research stations to serve the machinery industry in the same way that the Ontario Ministry of Agriculture and Food agricultural representatives, field engineers and research stations serve the technical and scientific needs of agriculture.

Some attempts are being made, both provincially and federally, to address this concern in Ontario and other parts of Canada, but at present, the lack of technical expertise and resources, as well as the perception of where they might logically fit in the larger economic scheme of things, is an apparent shortcoming of many small and medium (and notably some large) Ontario machinery manufacturing companies. This may be seen as a principal reason why many of them have not kept pace with the technology that is available, and why many of them have not grown beyond their local markets.

This is in sharp contrast to the agricultural industry where there is a very obvious consciousness about being world competitive and technologically up-to-date. That is to the credit, in large part, of the agricultural fraternity, its members, and their behaviour.

CHAPTER TWO

A QUALITATIVE PICTURE OF THE ONTARIO FARM MACHINERY INDUSTRY

Profile of Ontario Farm Machinery Manufacturers

The farm machinery industry in Ontario is comprised of manufacturers, dealers and organizations that represent or speak for the various facets of the industry. In the commentary that follows, and in aid of presenting a "picture", Ontario machinery manufacturers have been categorized as large, medium and small, based on their sales volume and the number of employees. In presenting this profile, many of the following comments are generalizations, and many exceptions undoubtedly exist, but for the purpose of presenting a "picture", it is thought to be quite correct.

As mentioned above, manufacturers are categorized as large, medium or small.

Large	-	over 200 employees	-	Sales over $20M.
Medium	-	50-200 employees	-	Sales $2M - $20M.
Small	-	less than 50 employees	-	Sales less than $2M.

Basic activities in most manufacturing companies consist of design, production and marketing. Large, and some medium, manufacturers carry out research and development and extensive testing of their equipment prior to production. A comparison of these activities among the three categories is presented under the following headings:

Design and Technical Capabilities

Large companies have engineering departments composed of trained professionals specializing in various fields of engineering, such as agricultural, mechanical and electrical engineering. These professionals have access to the latest design and engineering aids such as computers, CAD (Computer Aided Design), and information systems.

The medium size manufacturers have engineering departments also, but these are not as elaborate as those of the large manufacturer. They do however employ professionals trained in specialized areas for the product they manufacture.

Small manufacturers generally operate on an owner/operator basis, and most often the owner/operator has a background which involves a craft or skill, such as machinist or welder. Often too, or instead, they have a machinery sales or financial background. Generally, there are few technical professionals employed by small companies, and there is accordingly little professional engineering involvement in the design of their products.

Research and Development

Research involves the investigation of new and innovative ideas. Large manufacturers have a significant involvement in research and often have elaborate in-house research facilities, or may sometimes invest in subcontracting the research investigation. In addition to research, their product development and testing departments build prototypes and conduct very detailed testing programmes involving the gathering of field operational data used in accelerated testing in the laboratory to simulate field conditions. Stress, fatigue, noise and vibration tests are examples of the tests carried out by most large manufacturers.

In conjunction with R&D, the testing departments of large manufacturers evaluate the structural, functional, and safety aspects of the machines. At the final prototype stage, a safety committee may evaluate the product and make recommendations for design changes. Engineering departments typically design and build prototypes which are tested and developed in a span of 3-5 years. These prototypes are typically tested in a testing department and in the field. Trial production runs are usually carried out in order to do value analysis and to streamline production procedures. Often, a limited number of units are put on the market for evaluation as a final stage of the production development, prior to general promotion and production. These facilities are usually quite elaborate in large manufacturing companies.

The marketing departments of medium size companies typically request the introduction of new products that complement their existing line. Potential new products are evaluated on the basis of sales forecasts, development time, and economics of production considerations. Some medium size manufacturers have development engineering groups, but most either purchase the technology or rely on the supply of information from universities, colleges, and government centres. Based on this technology, they develop their new products, or make changes to their existing ones.

Medium size manufacturers usually conduct testing programmes which may be carried out in the laboratory as well as in the field. Testing facilities typically are not as elaborate as those of large manufacturers.

Usually, the small and medium manufacturers are product driven rather than trying to serve the market defined by the agricultural fraternity. Small manufacturers with limited resources seldom carry out elaborate market research and thus operate with a somewhat limited focus. Consequently, the small manufacturers usually only serve a small geographical market.

Small manufacturers are very rarely involved in any type of research except for the evaluation of performance and safety features of their products. Because medium and large companies are seldom interested in the products produced by small manufacturers, largely because the size of the market for them is too small, there is often little or no serious research and development performed for many specialized small volume machinery products. Therefore, small manufacturers rarely have any research information available for product development.

Shop/Production Capabilities

High volume production requires an organized structure in order to keep control of production, inventory and quality. Large manufacturers typically keep up with the latest technology in production such as the use of CAM (Computer Aided Manufacturing), robotics, statistical quality and process control, and large computer systems for inventory and production control requirements.

The Canadian branches of some multinationals usually manufacture a selected number of items from a diverse line of equipment, which the parent company markets to much broader markets. The greatest volume of the items produced in Canada is usually exported to the United States.

Medium manufacturers typically have some fairly up-to-date manufacturing facilities, and are adopting new technology in production and quality control, often because they may have agreements with large companies to produce a part of a machine or complete pieces of equipment for them. Quality and schedule demands from the marketing sections require the introduction of advanced technology in production, and a number of medium manufacturers continually update their facilities to meet these demands.

Small manufacturers are typically batch type operations, and produce a variety of products in other than assembly line facilities. Low volume production seldom justifies the investment required to introduce high technology production systems; consequently many small shops are using technology and machinery which may be more than 20 or 30 years old. There are some small manufacturers producing specialized equipment, such as electronic controls, and monitors which require them to use the latest technology in production and quality control.

Marketing Activities

Advertising, promotion and sales are integral parts of marketing and are adopted in varying degrees by large, medium and small manufacturers.

Large manufacturers have extensive advertising and promotional programmes on an international and national scale. Products are typically distributed through a network of dealers throughout Ontario and Canada. The dealer network is supported by the large manufacturers through product training sessions, usually concentrating on and coincidental with new product introductions that also include the latest sales literature, warranty policies and conditions, sales techniques, finance plans and other marketing related information. The large manufacturer typically provides training in the proper maintenance and servicing procedures and parts supply programmes for the dealer's service personnel.

A similar system on a smaller scale is used typically by the medium manufacturers. Rarely do the dealers representing the medium size manufacturer sell only products from that manufacturer. They also market products from at least other medium and small manufacturers and often handle products from a large manufacturer who may be either Ontario based or located outside of Ontario. Consequently, the medium size manufacturer competes with all other manufacturers represented by a dealer for the dealer's time and attendance at sales and service training sessions sponsored by the manufacturer. There are some medium manufacturers operating with direct sales. Some medium size companies have joint arrangements with foreign firms to market parts and equipment in Ontario.

Small manufacturers on the other hand operate in limited geographic areas, such as a few counties, and are able to service these with local advertising and direct sales on a personal basis with a small sales team.

Communication Links with the Agricultural Fraternity and the Farmer

Communication links between manufacturers and the agricultural fraternity and the farmer vary with the size of manufacturing companies.

Large manufacturers generally communicate with the universities, colleges and agricultural research stations to utilize research information and data in the development of their products. Usually, most in-house research information is treated as confidential in large manufacturing companies in order to maintain a competitive edge in the market. Direct communication with farmers is largely absent, since large manufacturers market their product through dealer networks and usually expect individual dealers to communicate on behalf of the company.

Some medium manufacturers have links with universities, colleges, and agriculture research centres for product evaluation and often procure technical information for product development. Often, medium size manufacturers contact farmers to evaluate the performance of machines, which are sometimes loaned directly to the farmers or through dealers. In some cases, manufacturers may send out forms with every piece of machinery requesting comments on its operation, safety and performance. This type of feedback is utilized in product improvement and future design considerations.

Small manufacturers have close links with their customers and frequently operate on an individual and personal basis in evaluation and modification of machinery to the extent of making customized units. As opposed to large manufacturers, they do not have much association with universities, technical societies, agricultural research centres, and other farm machinery related organizations.

Perceptions of the Machinery Industry as a Marketplace by Farmers, Manufacturers, and Entrepreneurs

Three figures prominent in the farm machinery sector are the farmer, manufacturer, and entrepreneur. Each live in a somewhat different world and their different perceptions of the same industry illustrate the absence of the "fraternity approach" to the farm machinery industry.

Farmers normally purchase machinery from dealers who carry a variety of equipment, which may have come from large, medium, and some small manufacturers. The differences in the technical and manufacturing capabilities of the three types of manufacturers is not apparent or realized by the farmer, and the farmer typically expects the machines to perform exactly to his particular needs. Quite often, modifications are made on the machinery by the farmer after it has been purchased, if these particular local needs are not met exactly. It is difficult, and of course often unnecessary, for the farmer to recognize that dependent on the size of the market for a particular product, the view of breadth of requirement the particular design is to cover, is different for small, medium or large volume items. The price of the machine is a major consideration at the time of purchase, but farmers generally expect the machines to be bigger, heavier and more durable, without regard to the manufacturer's design and marketing criteria.

Small manufacturers usually serve a very limited area and number of customers, and therefore are in closer contact with them. Individual customer satisfaction is their prime objective in order to maintain the market for the other products they typically promote to this same small group of customers.

Historically, large and medium manufacturers were typically geared up for large volume production and used production machinery which required extensive planning and time to make changes for the production of new products. In the more recent market, many large and medium manufacturers are adopting more advanced technology such as robotics and CAM. The perceived advantage is that they are able to change product designs and products more quickly, which enables them to dominate a market making it difficult for the small manufacturers to compete.

Large manufacturers look at the latest or future markets and are interested in large volume production. Products are designed to satisfy a wide range of customers throughout the country and the world. The indicators and requirements from the agriculture fraternity are closely considered and these large manufacturers usually stay in front of their markets. The use of dealer networks for the distribution of their products tends to isolate them from the end user resulting in design and production of machinery which has its basis "the least that will do the job adequately". This is an often heard expression in industrial design offices, as it is the usual best business approach which will yield the best return on investment.

Investors and entrepreneurs compare the farm machinery industry to other industries such as forestry, mining, real estate, etc. for an opportunity to invest. Farm machinery customers are usually perceived as honest, reliable, and hard working people who are usually lifetime customers in a reasonably stable industry. The farm machinery industry as a whole is perceived as an enterprise with a steady return on investment, with cyclical trends in different segments within the industry, as opposed to the boom or bust type of environment more prevalent in the auto and other similar narrow product line industries.

Commentary on Ontario Dealers and Distributors

Farm machinery dealerships and distributors are located throughout Ontario. The majority of these dealers are a part of the variety of national networks set up by large main line manufacturers. Financial planning, inventory, display, promotion and service guidance is typically available to the dealers and is provided by a team of representatives from the manufacturers.

The dealerships are usually run as private businesses and have contracts with the large and some medium manufacturers. Since they typically serve a local market and are selling for a commission or markup, the source of the equipment is not as important as "what sells", therefore, there appears to be very little Canadian product loyalty. Availability of equipment at low carrying cost encourages dealers to carry product lines and spare parts from various parts of the world. As private businesses, dealers are usually not restricted to selling only farm machinery, and many dealers sell recreational vehicles and other equipment along with agricultural related equipment. The key to product variety is "what sells".

Business Structure and Buyer/User Interface

The complexity of the business structure in the farm machinery industry varies with large, medium and small manufacturers, and is also influenced by the market they strive to serve.

Manufacturers' Priorities and Influences

The priorities of manufacturers are based on the end product or product lines that will sell, and which will provide a suitable return on investment. As indicated earlier, often, the priority of equipment design and production is the "least that will perform

adequately", and this is used as a guideline to the introduction, design and marketing of products which are likely to provide the most attractive overall sales volume, return on investment and total profit package. Usually, when a new and innovative product is introduced into the market, it is relatively highly priced, because of development costs, low production volumes, and start up inefficiencies, but as the competition grows and in-house techniques are improved, the price is often lowered.

However, in instances when companies decide to discontinue a product because of stiff competition and/or return on investment considerations, they sometimes dump the remaining product at cost or even below cost. In general, most manufacturers decide on a product that will sell, is the most productive to manufacture, and contributes to the "bottom line". Such decisions are influenced by regulations imposed by finance, labour, transportation, and safety regulations at the production facility.

Some of the major manufacturers were less affected by the recent years' critical economic turndown because they had invested in advanced technology, both in design and production during the healthier years, and thus were able to produce and market machinery at competitive costs. As a result, these companies have remained profitable and gained in market share while others have had to struggle to survive. New technology adaptation such as CAD/CAM, robotics, statistical process and quality control has been a boon to large manufacturers because of their ability to justify the capital required to automate their large production runs. The small manufacturers in contrast are threatened by this trend, since they typically handle too many products lines and serve too small a market. The difficult alternative which may be necessary for many of them to survive or avoid shrinking is to reduce the number of product lines and expand the marketing for those remaining. This will be difficult for many because of lack of capital.

Competition created by a free world market adds pressure on manufacturers to produce equipment that is competitive, and at the same time, performs well. Sometimes, these pressures tend to eliminate the emphasis or inclusion of safety features on the products, particularly if there is a price disadvantage by adding the safety features.

Most large and medium manufacturers employ professionals for product design and development, and are aware of standards and safety features set by professional societies and standards organizations. However, the threat of lawsuits and company pride are some of the key motivators in including safety features on machines. There is, of course, no enforcement body to ensure that safety features are a standard item on machines.

Even if there was one, and as discussed in Chapter Five, and noted in this chapter, dialogue with the Ontario manufacturers is difficult since there is no single voice representing all or a majority of these manufacturers of farm machinery or acting as a liaison. At the final development stage, cost reductions, product pricing and marketing priorities sometimes result in the elimination or reduced emphasis on safety features.

Distributor/Dealer Priorities and Influences

Priorities of dealers relate to volume of products sold and margins of profit from each product. Communication with customers and manufacturers, along with provision of service, spare parts, training programmes, and promotion of products, support the operation of the dealerships.

Dealership operations are influenced by the presence of other competitive dealers and their location. Crop conditions, which may be good or poor for any given time, may also influence the ability of dealers.

The distributors and dealers decide on products that will sell, and try to acquire product lines that are compatible and sell in the market in which they normally operate, and which do not require special sales teams. There are some medium size manufacturing firms distributing products because of the above mentioned criteria. The source of the product, whether domestic or foreign, has very little apparent influence on many dealers, as long as the product sells.

Farmer/User Priorities and Influences

Priorities of most farmers, it would appear, are the maximum production of good quality products with the least cost of production. Perhaps, too low on their priority list, is safety.

The farmer customer becomes aware of machinery, new or used, from advertisements in farming magazines, newspapers, demonstrations at farm shows and dealerships, and from other farmers. Generally, farmers see a machine and try to assess the potential increase in efficiency and cost benefits for their particular situation before making a purchase. Safety, as a purchasing factor, is perceived as being low on the farmer's list of priorities that influence the desirability of a unit. High on this list are improving efficiency, addressing a specific farming need, good services, good value for the dollars spent, and

possibly even income tax considerations. A factor not entirely absent with a few farmers, particularly those with peer competition concerns, is to have the biggest, the loudest and apparently the best machinery in his community. Machoism is somewhat evident in these farmers' purchasing habits. When times are good, farmers buy what they want. In leaner times, farmers must buy what they can afford, or can get by with.

A variety of factors such as economics, weather, markets and efficiency influence a farming operation. The effects of each of these factors may result in either a successful operation or a failure. Factors such as the weather cannot be controlled and difficult financial situations force farmers to purchase used equipment, which may result in greater potential of accidents.

Bigger farms are usually run as a business, and since they employ people, the farmer employer has a penalty to pay, both in increased workers compensation rates and in loss of production, if the workplace is not safe and accidents occur on the farm. Most farm employers pay the assessed rate to the Workers' Compensation Board for each of their employees. A number of farm employers do not consider personal coverage necessary and presumably feel that they can do without it.

Farm Employee/User Priorities and Influences

Good working conditions with reasonable salary and working hours are some of the priorities of farm employees. On the majority of the farms, the farm employees have little influence in the decision to purchase machinery. Their primary function is to operate machinery and do the repair and maintenance work. There is no enforcement body to regulate safety standards for working conditions on farms. The weather and other factors, especially at seeding and harvesting time, play a significant role in creating hazardous situations when farmers tend to be in a hurry to get their work completed.

Principal Organizations in the Farm Machinery Industry

There are numerous organizations and associations involved in various aspects of the farm machinery industry. Some relate directly to manufacturers, and others to dealers. In addition, some organizations have a mandate to promote and encourage education, research, and standards in the agricultural machinery industry.

It is interesting to note that in the investigation of the organizations in the farm machinery industry, no single organization was found to represent all the Ontario, or Canadian farm machinery manufacturers as manufacturers. In fact, of the one hundred and thirty machinery manufacturers identified in Ontario, it is observed that only nine were represented as farm machinery manufacturers in the only association, namely CFIEI (Canadian Farm and Industrial Equipment Institute), which represents farm machinery manufacturers in their interest as farm machinery manufacturers.

The nine Ontario manufacturers that belong to CFIEI are all medium or large, are principally multinational in nature, and very likely represent the majority, in terms of dollar volume, of the farm machinery that is manufactured in Ontario. The other one hundred and twenty are the medium and small companies and, accordingly, have substantially different priorities and concerns than the large companies. It is perhaps this non-representation that is one of the weak links of the Ontario farm machinery industry. There is, for example, no means for a government or other body to speak to that group as an industry and no means for that group to gather and voice its collective interests.

The following listing of organizations is categorized as those that try to speak for the industry and those that service the industry. A detailed description of each of these organizations and associations is provided in the following pages.

Principal Organizations that Speak For or Represent Specific Segments of the Farm Machinery Industry

1. Ontario

    (a) Ontario Wholesale Farm Equipment Dealers Association (OWFEA)
    (b) Ontario Retail Farm Equipment Dealers Association (ORFEDA)
    (c) Agricultural Export Association of Ontario (AGREXO)

2. Other Provinces

    (a) Prairie Implement Manufacturers Association (PIMA)

3. Canada

   (a) Canadian Farm and Industrial Equipment Institute (CFIEI)

4. United States

   (a) Farm Equipment Manufacturers Association (FEMA)
   (b) Farm and Industrial Equipment Institute (FIEI)

Organizations that Serve the Industry

1. Ontario

   (a) Ontario Farm Machinery Board (OFMB)
   (b) Farm Safety Association (FSA)
   (c) Agricultural Universities and Colleges of Agricultural Technology
   (d) Ontario Ministry of Agriculture and Food
   (e) Ministry of Industry and Trade
   (f) Ontario Centre for Farm Machinery and Food Processing Technology

2. Other Provinces

   (a) Prairie Agricultural Machinery Institute (PAMI)

3. Canada

   (a) Canadian Society of Agricultural Engineers (CSAE) and the Agricultural Institute of Canada (AIC)
   (b) Canada Safety Council
   (c) Agriculture Canada

4. United States

   (a) American Society of Agricultural Engineers (ASAE)

Ontario Wholesale Farm Equipment Association (OWFEA)

The objective of the OWFEA is to upgrade the marketing and sales operation of its members. This is achieved through newsletters and meetings held during the year, making the members better acquainted with how each other relate to the industry. OWFEA has thirty-five members comprised of manufacturers and dealers located in Ontario.

Ontario Retail Farm Equipment Dealers' Association (ORFEDA)

ORFEDA is a non-profit provincial organization founded in 1945, and is the recognized voice of the farm equipment dealers with over three hundred dealer members. The association's objective is to upgrade the dealer's operation, through improving applicable legislation, taxation, financial management, accounting, insurance and service to customers. These objectives are achieved by making presentations to the provincial government, supplying trade publications, bulletins, and conducting trade seminars. The association also supplies insurance counselling and legal representation to its members. ORFEDA is affiliated with the Canadian and National Dealers Association.

Agricultural Export Association of Ontario (AGREXO)

AGREXO is an incorporated, non-profit association started in May, 1984. It is the first export association of Ontario developed exclusively for the promotion of agriculture related companies and the export of their products in the export markets. It is controlled and directed by its member companies through a nine member Board of Directors representing various agriculture related industries.

AGREXO serves its members by making them known to the various federal and provincial government departments and agencies for the promotion of export, and providing sales leads.

Prairie Implement Manufacturers Association (PIMA)

PIMA was incorporated as a non-profit association in 1970 to foster and promote the growth and development of the farm equipment manufacturing industry in Alberta, Saskatchewan, and Manitoba. The association speaks as a single voice on behalf of the industry, establishing and maintaining liaison with government related associations,

related industry and the general public. Their objectives are also to encourage governments to enact legislation and offer programmes that enhance the growth potential of the industry, promote the expansion of markets for Prairie made farm equipment at home and abroad, and to assist member companies to improve their management and operation skills.

Some farm equipment component manufacturers and raw material suppliers from Ontario belong to PIMA as associate members.

Canadian Farm and Industrial Equipment Institute (CFIEI)

CFIEI primarily represents a body of large manufacturing companies or corporations engaged in the manufacture or sales of farm and industrial equipment. The primary objectives of CFIEI are: to supply a forum for improved co-operation and dialogue between member companies; provide a unified industry position with provincial and federal government bodies whose mandates can affect the operation of institute members, the farming community and agribusiness in general; and to assist members to develop and measure their respective sales strategies.

Responsibility for governing the affairs of the Institute rests with the officers and directors drawn from the executive ranks of the active member companies. Reporting to the Board of Directors, and responsible for the daily activities, is a general manager.

To accomplish the objectives, the Institute functions primarily through various committees, which are ultimately responsible to the Board through the general manager.

Farm Equipment Manufacturers Association (FEMA)

FEMA's objectives are to upgrade the service, management, quality of products and marketing segments of the small farm machinery manufacturers.

The Association is based in the United States and has a small number of Canadian members. FEMA represents the small specialized group of manufacturers as opposed to FIEI, which represents mainly the large and some medium sized manufacturers.

A service provided by FEMA is the use of the "Seal of Quality". This trademark is designed to upgrade the image of the short-line manufacturer's products. To qualify, the

companies must adhere to a rigid set of standards approved by FEMA's fifteen person Board of Directors. Included are such requirements that manufacturers provide complete operators manuals, and repair parts lists with each machine. All machines carrying the Seal must carry a written warranty. Manufacturers must also agree to furnish repair parts on qualified models for a minimum of ten years from date of manufacture.

To keep its members up to date with the latest management and marketing techniques, FEMA periodically arranges conventions and clinics. The Association also provides newsletters, management aids, cross indexing and market surveys for effective communication between its members.

Farm and Industrial Equipment Institute (FIEI)

The Farm and Industrial Equipment Institute is an organization based in the United States. The Canadian Farm and Industrial Equipment Institute is the Canadian affiliate of FIEI.

Ontario Farm Machinery Board (OFMB)

The Ontario Farm Machinery Board was established, and is funded, by the Ontario Ministry of Agriculture and Food to act as an intermediary body between farmers, manufacturers and dealers to resolve disputes regarding warranty, performance and sometimes safety problems. The Board attempts to solve problems before they are publicized, by recommending or carrying out a study or test, and then presenting the solution to the concerned organization for adoption. The Board is a liaison organization between farmers, farm organizations, dealers, and manufacturers, and is comprised of ten members who are farmers, manufacturers, educators, and dealers. The Board's daily operations are run by a Secretary-Manager, whose office is located in Toronto.

Farm Safety Association (FSA)

A detailed description of the Farm Safety Association is provided in Chapter Five.

Agricultural Universities and Colleges of Agricultural Technology

Agricultural universities and colleges are engaged in the education and research work related to agriculture. Original research in agricultural engineering, with considerable

emphasis on farm machinery, and the promotion of the science and art of agricultural engineering, are some of the prime objectives of these institutions. Information collected at universities and colleges is available to the public free of cost and is distributed through seminars, technical papers, and through various government centres such as offices of the Ontario Ministry of Agriculture and Food.

Ontario Ministry of Agriculture and Food

The Ontario Ministry of Agriculture and Food is comprised of various departments specializing in the improvement of production, quality and marketing of all farm commodities in the province of Ontario. OMAF sponsors many organizations such as the Farm Machinery Board and colleges of agricultural technology, and provides a co-ordinating function of many of their activities in Ontario. The Ministry recognizes that the machinery industry is a link in the overall chain that makes up the agricultural industry. OMAF operates through representatives located at the colleges and county agricultural offices, and provides training programmes and extension services to disseminate information regarding application of new technology in Ontario.

Ministry of Industry and Trade

The Ministry of Industry and Trade recognizes the need to increase productivity in Ontario, and has developed programmes to introduce new technology through the technology centres, among other means. One example of this is the Ontario Centre for Farm Machinery and Food Processing Technology, whose mandate has been referred to in Chapter One.

Ontario Centre for Farm Machinery and Food Processing Technology

A detailed description of the Technology Centre's mandate and activities is provided in Chapter One.

Prairie Agricultural Machinery Institute (PAMI)

The Prairie Agricultural Machinery Institute is a co-operative undertaking of the Canadian provinces of Alberta, Saskatchewan, and Manitoba. The Institute provides a unique resource to the farmer and agricultural machinery manufacturers with its goal "to improve the design, and aid in the selection and use of agricultural machinery". To meet

its objectives of evaluating existing agricultural machinery and developing new and improved machinery, the Institute operates three facilities located in Humboldt, Saskatchewan, Lethbridge, Alberta, and Portage la Prairie, Manitoba.

PAMI is directed by a council of appointed farmers, implement dealers, manufacturers, and government and university representatives from the three provinces.

Agricultural machinery evaluation for functional performance is a major part of PAMI's work. The results of this work are published in report form and are available by subscription from the Institute.

Agricultural machinery related research is conducted by the Institute on its own and in co-operation with other research organizations or interested manufacturers.

Canadian Society of Agricultural Engineers (CSAE) and the Agricultural Institute of Canada (AIC)

The CSAE is a non-profit professional society, which exists to serve its members and Canadian agriculture by improving communications between the various facets of the industry.

CSAE objectives are to advance the application of Engineering principles and practices for the betterment of agriculture and the allied sciences, and to advance the standards of Agricultural Engineering in the fields of research, education, and practical application. They also encourage professional improvement and foster Agricultural Engineering education, which of course, includes farm machinery topics. CSAE is managed by its council of elected members, and operates through an executive and regional directors. The regions are Atlantic provinces, Quebec, Ontario, Manitoba, Saskatchewan, Alberta, and British Columbia. The members are located across Canada and in foreign countries and are working in industry, government, universities and farming. Members provide expertise in the areas of farm machinery, power and machinery, structures, environment, soil and water and electrical power and processing, waste management and food engineering.

The CSAE is affiliated with the Agricultural Institute of Canada (AIC). Canadian agricultural professionals first organized in 1920, as the Canadian Society of Technical Agriculturalists (CSTA), which grew and became the Agricultural Institute of Canada in

1945. AIC is a national organization uniting eight provincial institutes of agrologists and nine agriculture related scientific societies.

Canada Safety Council

A detailed description of the Canada Safety Council is provided in Chapter Five.

Agriculture Canada

The department of Agriculture Canada is responsible for federal policies, programmes and regulations relating to agriculture and food. It is involved in such activities as grading and inspection, seed certifications, the regulation of pesticides and fertilizers, scientific research, international agricultural liaison, and the dissemination of information. Research relating to agriculture is carried out at various research stations located throughout Canada. As part of this activity, development and testing of farm machinery are included among the activities of Agriculture Canada.

American Society of Agricultural Engineers (ASAE)

The American Society of Agricultural Engineers is the non-profit professional society that serves the scientific, educational, and technical needs of engineering in agriculture. The objects of the society are to promote the science and art of engineering in agriculture; to encourage original research; to foster agricultural engineering education; to advance the standards of agricultural engineering; to increase and extend the association of agricultural engineers among themselves and with allied scientists and technologists; to encourage the professional improvement of its members, and severally and in co-operation with other groups to broaden the usefulness of agricultural engineering.

ASAE serves through national and sectional meetings, special conferences, committees, publications, the Co-operative Standards Programme, which includes standards for farm machinery, and in co-operation with many other related organizations, ASAE accepts only individuals as members. ASAE Standards, engineering practices, and data are informational and advisory only. Their use by anyone engaged in industry or trade is entirely voluntary. There is no agreement to adhere to any ASAE Standard, engineering practice, or data. The ASAE assumes no responsiblity for results attributable to the application of these Standards, engineering practices, and data. Conformity does not ensure compliance with applicable ordinances, laws and regulations.

ASAE is an American professional society, but has a large Canadian membership made up of professionals related to agriculture and engineering.

CHAPTER THREE

MANUFACTURERS OF FARM MACHINERY USED ON ONTARIO FARMS

In the production of agricultural commodities, Ontario farmers use a wide variety of farm machinery obtained from manufacturers within Ontario, other provinces and different parts of the world. A listing of farm machinery manufacturers, from each of the above mentioned sources, is presented in the following sections.

Distribution and Location of Farm Machinery Manufacturers in Ontario

The total number of Ontario farm machinery manufacturers listed is one hundred and thirty. An analysis according to size reveals that about sixty-five percent are small manufacturers, thirty percent are medium manufacturers and four percent, large manufacturers. A definition of the large, medium, and small manufacturers is provided on Page 9. It should be noted in the following listing, that the size of company categorization is an attempt to define the size of the machinery component of these businesses, and not the total size of the companies. Many of these companies produce many additional products that are not farm machinery items, and some in volumes greater than their farm machinery products.

The highest concentration of manufacturers is in the Kitchener-Waterloo region followed by the London, St. Thomas, Tillsonburg area, and the Hamilton and Toronto regions. There is also a group in southern Ontario located in Windsor, Leamington, Chatham, and another in the Niagara peninsula. There are companies sparsely located in the western Ontario region covering Huron, Bruce, and Perth counties, but there are very few farm machinery manufacturers east of Toronto.

The large manufacturing companies produce high volume products which are generally quite complex, for example, combines, forage harvesters, tractors and grain drills. The medium size companies tend to produce short line equipment and products that seem to fill the gap left by the large companies. Grain storage and handling equipment, irrigation equipment, cultivators, sprayers, and some specialized equipment for growing tobacco and vegetable crops are some, from a wide range of products, produced by medium size manufacturers. Many small manufacturers service a local market with some very specialized equipment such as feeders, conveyors, farm wagons, trailers, hitches, sprayers, hog pens, liquid manure handling machinery, feed carts, wheelbarrows, and various attachments or modification kits to adapt machinery to local conditions.

For the purpose of the Ontario Technology Centre's mandate, it has defined a farm machinery manufacturer as any company that produces a significant piece of equipment that is found on a farm (excluding the house), and that is normally purchased as a stand alone and complete item. Beyond the normally accepted pieces of tractor drawn or self propelled pieces of equipment, this definition would include the manufacturers of such items as agricultural pumps, heat exchangers for barns, equipment found in barns and material handling equipment. Using this definition, the following is a listing of Ontario farm machinery manufacturers identified to date.

This list may not be as comprehensive, nor the product listings as complete, when compared to that provided by PIMA (Prairie Implement Manufacturers Association), as there is no similar association which represents or includes as members, the small manufacturers in Ontario. Consequently, the categorization of size of company is somewhat empirical and is based on less than adequate information and some opinions.

Large Farm Machinery Manufacturers and their Product Lines

Company	Products Manufactured
Deere, John; Welland Works of John Deere Limited Welland, Ontario	- front end loaders - manure spreaders - rotary cutters - snow-blower wagons - grain and forage boxes - rear blades - disc harrows - seeding tillers - header transporters
International Harvester Company of Canada Limited Toronto, Ontario	- forage harvesters - grain drills - cultivators - manure spreaders - self propelled windrowers

Company	Products Manufactured
Massey-Ferguson Industries Limited Toronto, Ontario	- self propelled combines - disc harrows - hay balers - tractor cabs - cornheads - pull-type combines - 4-wheel drive tractors
MTD Products Kitchener, Ontario	- garden tractors - wheelbarrows - garden tillers - hose clamps
Westeel-Rosco Limited Toronto, Ontario	- grain bin aeration equipment - steel pre-engineered buildings - galvanized steel cladding
White Farm Equipment Canada Limited Brantford, Ontario	- combines - headers

Medium Farm Machinery Manufacturers and their Product Lines

Company	Products Manufactured
B & L Metal Products (Elmira) Limited Elmira, Ontario	- livestock penning
Bartlett, N. M. Incorporated Beamsville, Ontario	- fruit and vegetable grading equipment
Berglund Industrial Supply Company Limited, Thunder Bay, Ontario	- grain cleaning equipment and supplies

Company	Products Manufactured
Canarm Limited Brockville, Ontario	- exhaust fans - agricultural hay dryers - grain dryers - heat lamps - ceiling fans - slow moving vehicle signs
Canners Machinery Limited Simcoe, Ontario	- strawberry harvesters
Chapman's Grain Equipment Limited Chatham, Ontario	- grain storage and handling equipment
Construction Machinery Company Canada Limited, Kitchener, Ontario	- weigh hoppers
DeCloet Limited Tillsonburg, Ontario	- bulk curing tobacco kilns - tobacco harvesters - sprayers - topping machines - portable steam boilers
Delta 70 Manufacturing Company Harrow, Ontario	- rack decking - conveyor guards - wire mesh shipping containers
Demuth Products (Canada) Limited Waterloo, Ontario	- silo hardware - silo bottom-top unloaders - livestock feeding system and mixers
Erie Iron Works Company Limited St. Thomas, Ontario	- wheelbarrows - augers - post hole diggers

Company	Products Manufactured
Etatech Industries Incorporated Brantford, Ontario	- electric motors
Farmatic Incorporated Gorrie, Ontario	- roller mills - hammer mills - augers - bucket elevators - air systems
Gorman-Rupp of Canada Limited St. Thomas, Ontario	- agricultural irrigation pumps
Hallman, J. C. Manufacturing Company Limited, Kitchener, Ontario	- battery operated electric fencers - hydro powered electric fencers - steel and fibreglass fence posts
Huron Canadian Fabricators (1980) Limited, Seaforth, Ontario	- belt conveyors - grain elevators - screw conveyors - cyclones - rotary cleaners - grain handling equipment
Hurst Equipment Limited Bloomingdale, Ontario	- heated livestock waterers - automatic hog feeding equipment - environmental control systems - general poultry equipment
Jamesway Company Cambridge, Ontario	- poultry incubators
Kenhar Products Incorporated Guelph, Ontario	- fork lift trucks

Company	Products Manufactured
Ketchum Manufacturing Sales Limited Ottawa, Ontario	- livestock and poultry identification equipment
Kongskilde Limited Exeter, Ontario	- field cultivators - row crop cultivators - moldboard ploughs - pneumatic conveying equipment - chisel ploughs
MacDonald Steel (1976) Limited Cambridge, Ontario	- vacuum pumps - blowers - fans - packaging machinery
Martin Structures Limited Georgetown, Ontario	- agri-ventilators - agri-aerators
Murphy, N. R. Limited Cambridge, Ontario	- dust collecting equipment - industrial fans
Myers, F. E. Canada Limited Kitchener, Ontario	- centrifugal pumps - submersible pumps - sewage system submersible pumps
Noront Steel (1981) Limited Copper Cliff, Ontario	- potato harvesters
Omark Canada Limited Guelph, Ontario	- chain saws
Omnitech Steel Works Limited Chatham, Ontario	- corn/grain processing equipment - custom material handling system loaders

Company	Products Manufactured
Powell Agri-Systems Limited Otterville, Ontario	- bulk tobacco curing systems - tobacco harvesters - sprayers - corn detasselers - transplanters
Sellick Equipment Limited Harrow, Ontario	- rough terrain fork lifts - fork lift bucket attachments
Terra Steel Corporation North Bay, Ontario	- pre-engineered steel buildings
Thunder Bay Northland Machinery Incorporated, Thunder Bay, Ontario	- grain cleaning machines
Trenton Machine Tool Trenton, Ontario	- food processing equipment
Turnco Corporation Blenheim, Ontario	- grain wagons - tillage equipment - packers - sprayers
Vicon Incorporated Cambridge, Ontario	- field cultivators - round balers - crop sprayers - disc mower/conditioners - fertilizer spreaders
Walinga Body and Coach Limited Guelph, Ontario	- grain truck bodies - bulk feed pumps - corn and grain mobile units

Company	Products Manufactured
Ward Ironworks Limited Welland, Ontario	- apron conveyors - belt conveyors - belt feeders

Small Farm Machinery Manufacturers and their Product Lines

Company	Products Manufactured
AG-Tronic Manufacturing Limited Rexdale, Ontario	- slow-moving-vehicle emblems - generators
Altosar Corporation Limited Brampton, Ontario	- aquatic weed harvesters
Archibald, Ross and Son Dundalk, Ontario	- hay elevators - snow-blowers
Ariss Welding and Manufacturing Ariss, Ontario	- hog feeders - mink feeders - minifarm wagons - dump trailers
Baertsoen Manufacturing Limited Aylmer West, Ontario	- farm wagons - trailers - tobacco tillage equipment
Bannerman, Gordon Limited Rexdale, Ontario	- reel and rotary type mowers
Barry Metal Products Binbrook, Ontario	- cultivators

Company	Products Manufactured
Bauman Manufacturing Limited Waterloo, Ontario	- livestock pens - livestock feeding systems - manure handling equipment - custom farm machinery parts
Bell-Camp Manufacturing Limited Ingersoll, Ontario	- grain distributing and handling equipment - liquid manure tanks - liquid manure pumps - grain wagons - farm type dump wagons
Berg Equipment Company (Canada) Limited St. Thomas, Ontario	- hog pens - barn cleaners - cow stalls - cow pens
Berry-Hill Limited St. Thomas, Ontario	- poultry processing equipment - tobacco curing equipment - poultry laying cages - incubators
Belgium Standard Industries Waterloo, Ontario	- grain truck bodies
Bruns Welding and Manufacturing Limited, St. Jacobs, Ontario	- farm wagons - grain boxes - feed carts
Canada Farm Distributors Limited Tavistock, Ontario	- stone crushers - springs
Canada Mobile Feedmills Limited Puslinch, Ontario	- mobile feed mills

Company	Products Manufactured
Casier's Welding Delhi, Ontario	- tobacco equipment - asparagus cutters
Central Ontario Metal and Construction Brunner, Ontario	- flour mill systems - feed mills
Chain Harrows Limited Fergus, Ontario	- harrows
Chisholm-Ryder Canada Limited Niagara Falls, Ontario	- farm wagons - food processing machinery
Collect-O-Matic Systems Incorporated Komoka, Ontario	- egg collecting systems
Delhi Foundry and Farm Machinery Limited Delhi, Ontario	- transplanters - row crop cultivators - sprayers - soil pulverizers and packers - greenhouse sprinklers
Dorsser Incorporated Blenheim, Ontario	- grain elevators - concrete silos - pellet dies
Dundas Foundry Company Limited Simcoe, Ontario	- exhaust fans - ventilating fans - circulating fans
Dunham Bush of Canada Weston, Ontario	- heating equipment - air conditioning equipment - air compressors
Durose Welding Limited Guelph, Ontario	- trailers - tractor parts

Company	Products Manufactured
Enright Metal Products Limited Cambridge, Ontario	- poultry and livestock equipment
Epps Manufacturing Limited Clinton, Ontario	- high pressure water cleaners
Faromor Incorporated Waterloo, Ontario	- natural ventilators - hog stabling
Ford Dickison Industries Limited Brodhagen, Ontario	- barn ventilating fans - static pressure inlet system fans - poultry feeders - poultry cages - egg collection systems - manure augers
Fowler Metal Industries Limited Burford, Onatario	- trailer frames
Frey Livestock Equipment Moorefield, Ontario	- livestock squeeze gates - headgates - penning - scales
Frey Manufacturing Listowel, Ontario	- tractor front end loaders - auto feed system conveyors - feed mixing equipment
GEDACA Enterprises Limited Cambridge, Ontario	- electronic control systems
Gerrits, H. Barn Equipment Limited Clinton, Ontario	- hog stabling - rolling harrows

Company	Products Manufactured
Grayco Heidelberg, Ontario	- potato harvesters
Gropp Manufacturing Limited Markham, Ontario	- farm wagons
Gurbin, F., Engineering and Manufacturing, Essex, Ontario	- grain aerators
Haas, Jim Woodstock, Ontario	- silage inoculating equipment
HWE Agricultural Technology Limited Nepean, Ontario	- front mount lift mechanisms
Hardi, Incorporated London, Ontario	- agricultural sprayers
Heavy Duty Products (Preston) Limited Cambridge, Ontario	- grain rollers - grinders - feed mills - bulk milk tanks
Helm Welding Limited Lucknow, Ontario	- cultivators - silo pipes - snow-blowers
Herrgott Industries Limited St. Clements, Ontario	- wagons - cultivators
Husky Farm Equipment Alma, Ontario	- liquid manure systems - snow-blowers
Jaffa Machine Limited Aylmer, Ontario	- tobacco sprayers

Company	Products Manufactured
Janzen's Tomato Equipment Limited Ruthven, Ontario	- bedding equipment
Jordex International Alliston, Ontario	- grain storage bins - grain aeration equipment - farm buildings
Jim's Machine Shop Hensall, Ontario	- equipment for turnip crop - washers - conveyors
Johnsen Machine Company Limited Burlington, Ontario	- electrical soil pasteurizers
Kent Farm Supplies Limited Blenheim, Ontario	- bedding equipment
KMW Products Limited St. Catharines, Ontario	- hydraulic cylinders - tractor mounted front end loaders
Kuntz, H. Manufacturing Incorporated St. Jacobs, Ontario	- feed carts - wheelbarrows
L and B Moore Company Limited Uxbridge, Ontario	- grain drying fans - grain drying floors
Langeman Manufacturing Limited Leamington, Ontario	- vegetable harvesters - corn detasselers - conveyors
Leeson, T. F. and Sons Limited Woodstock, Ontario	- hoppers - conveyors - silo unloaders

Company	Products Manufactured
Lely Limited Burlington, Ontario	- liquid manure spreaders - hay handling equipment - rototillers - fertilizer broadcasters
Lift, B. T. Canada Limited Markham, Ontario	- scales - material handling equipment
Lincoln Sprayer Sales and Service Lincoln, Ontario	- sprayers
Martin, M. K. Enterprise Incorporated Elmira, Ontario	- elevator sections - bale racks - wagon running gears
Maple Leaf Manufacturing Company Rockwood, Ontario	- bale elevators - manure spreaders
M. C. L. Electronics Limited Pickering, Ontario	- bug killers
Mid-West Silo Systems Limited Wellesley, Ontario	- silos - manure tanks
Norse Industries Exeter, Ontario	- field cultivators - row crop cultivators
Nuhn Industries Limited Sebringville, Ontario	- liquid manure handling machinery - batch feed mixers
Middlesex Farm Systems Kerwood, Ontario	- barn equipment - stabling - cleaners - ventilators - manure, irrigating, spraying equipment

Company	Products Manufactured
Quality Suppliers Ilderton, Ontario	- manure handling systems - irrigation equipment
Rittenhouse, M. K. and Sons Limited Jordan, Ontario	- agricultural spraying machines (orchards)
Shur-Stor Systems Alliston, Ontario	- potato storage systems
Skipper, Kevin Merlin, Ontario	- tomato transplanters - gel seeding equipment
Smale, W. R. Company (1979) Limited Mossley, Ontario	- livestock handling equipment - hay feeders - farrowing crates - electronic weigh scales - cattle catch chutes
Smyth Welding and Machine Shop Auburn, Ontario	- snow-blowers - bale feeders - windrowers - wood splitters
Speedquip Industries Limited Dashwood, Ontario	- corn crib conveyor unloaders
Stirco Incorporated Chatham, Ontario	- feed mixers truck mount - feed mixers trailer mount - stationary units - silage cutters

Company	Products Manufactured
Sullivan Strong Scott Limited Downsview, Ontario	- conveyors - bucket elevators - chain conveyors - screw conveyors - belt conveyors
Suter, C. N. Limited Hagersville, Ontario	- orchard sprayers - field sprayers - high pressure washers - livestock feed carts
Svobco Equipment Limited Welland, Ontario	- bale conveyors
Thomas Harris Engineering Limited Brampton, Ontario	- cabs for agricultural equipment
Tilbury Metal Fabricators Limited Tilbury, Ontario	- farm fuel storage tanks - farm water tanks - 3 point hitch scraper blades
Tipping Motor Bodies Limited Schomberg, Ontario	- truck bodies - trailers
Tobac Curing Systems Limited Simcoe, Ontario	- industrial fans - tobacco harvesters - tobacco kiln curing equipment - peanut harvesters - tomato harvesters
Transfer Systems Incorporated Woodstock, Ontario	- hydraulic manure pumps

Company	Products Manufactured
Triangle Truck Equipment Limited Waterloo, Ontario	- dump trailers - truck bodies - waste containers
Tripp-Vogt-Trottier Limited Tillsonburg, Ontario	- bucket elevators - belt conveyors - anhydrous ammonia applicators
V and M Millwrights Limited Strathroy, Ontario	- grain bins - truck racks - legs for elevators
Van Eyl Farm Supply Clifford, Ontario	- scrapers - grain augers - wagons - cultivators - disc harrows
Weber, O. M. Industries Limited Hawkesville, Ontario	- grinding and mixing systems - liquid manure spreaders - conveyors
Yarmouth Metal Fabricators Limited St. Thomas, Ontario	- bins - grain handling equipment - industrial elevators - conveyors - stock carts

Canadian Farm Machinery Manufacturers Outside of Ontario

The majority of the farm machinery sold in Ontario that has been manufactured in Canada, but outside of Ontario, is produced in Saskatchewan, Manitoba, Alberta and Quebec. There is some orchard equipment manufactured in British Columbia.

Machinery produced in the prairie provinces includes a wide variety of equipment covering tractors, tillage, cultivation, planting, harvesting, hayhandling and spraying implements, as well as grain handling equipment. The prairie province manufacturers are represented by PIMA (Prairie Implement Manufacturers Association) and the following listings for the prairie provinces have been taken from PIMA's directory. A detailed description of this organization is provided on Page 21. There are also a number of companies outside Ontario supplying component parts for equipment manufactured in Ontario.

List of Canadian Manufacturers Outside of Ontario and their Products Marketed in Ontario

Company	Products Manufactured
Anderson Industries Incorporated Southey, Saskatchewan	- rod weeders - harrow attachments
Baker Engineering Enterprises Limited Edmonton, Alberta	- electronic monitors - land measuring devices - liquid meters - grain thermometers - grain bin level indicators - fence chargers
Beline Manufacturing Company Limited Kindersley, Saskatchewan	- electronic granular chemical applicators
Ber-Vac Incorporated Thetford Mines, P.Q.	- row crop cultivators - field cultivators - rolling wheel harrows - snow-blowers
Blanchard Foundry Company Saskatoon, Saskatchewan	- log splitters - sprayers - pressure washers - harrows - elevators

Company	Products Manufactured
Blanchard Foundry Company Saskatoon, Saskatchewan (continued)	- dozer blades - augers - fence chargers - cultipackers - bale feeders - feed and grain blowers - grain bin unloaders - grain moisture testers - cattle feeding panels - air pressure tanks - air compressors - abrasive cut-off saws - hay bale transporters - implement carriers - livestock handling gates - monitors (electronic) - post hole diggers - rock pickers and windrowers
Bass Engineering Limited Calgary, Alberta	- dozer blades - tractor frontmount loaders - loader buckets - loader grapple forks - loader hay forks - loader snow blades
Brandt Industries Limited Regina, Saskatchewan	- grain loaders - augers - sprayers
Canadian Steel Tank Limited Brandon, Manitoba	- grain bins - sprayers - crop drying fans - feed handling systems - fertilizer storage bins and tanks

Company	Products Manufactured
Canadian Steel Tank Limited Brandon Manitoba (continued)	- feed storage tanks - water transport tanks - anhydrous ammonia applicators - air pressure tanks - cultivator fertilizer attachments - corn planter fertilizer chemical banding attachments - light industrial tractors - liquid manure spreaders
B. R. Choiniers Ltee. Ste. Therese, P.Q.	- forage blowers - forage harvesters - forage wagons - bunk feeder wagons - hay bale wagons - wagon boxes
Co-op Implements Limited Winnipeg, Manitoba	- disks - chisel ploughs - mulch tillage implements - harrows - field cultivators - pull-type combines - tractors - windrowers
Degelman Industries Limited Regina, Saskatchewan	- dozer blades - rear blades - rock pickers and windrowers - harrows - chisel plough - field cultivators
Doepker Industries Limited Annaheim, Saskatchewan	- implement carriers - fifth wheel grain trailers

Company	Products Manufactured
Dorcal Industries (Calgary) Limited Calgary, Alberta	- elevators - feed storage tanks - feed handling systems - fertilizer storage bins - grain cleaners
Dynavent Farm Equipment Drummondville, P. Q.	- crop drying fans - silo unloaders - hand carts - snow-blowers
Edwards Rod Weeder Limited Lethbridge, Alberta	- grain drills - chisel ploughs - rod weeders - cultivators
Ezee-On Manufacturing Limited Vegreville, Alberta	- disk harrows - tractor front mount loaders - loader hay fork attachments - loader lift fork attachments
Farm King Limited Morden, Manitoba	- feed grinders - feed roller mills - grain cleaners - harrows
Flexa-Hoppers Plastics Limited Lethbridge, Alberta	- water storage tanks
Flexi-coil Limited Saskatoon, Saskatchewan	- cultipackers - harrows - pneumatic grain and fertilizer applicators

Company	Products Manufactured
Forano Agriculture Incorporated Plessisville, P.Q.	- rear mounted loaders - snow-blowers and throwers - sprayers
Friggstad Manufacturing Limited Frontier, Saskatchewan	- dozer blades - spring tooth harrows - chisel ploughs
Gearmatic Company Surrey, British Columbia	- tractor winches
Inland Industries Burnaby, British Columbia & Kelowna, British Columbia	- rotary tillers - power harrows - orchard mowers - field mowers - orchard picking and pruning towers - sprayers
Inland Steel and Forging Limited Winnipeg, Manitoba	- snow-blowers - sprayers - harrows
Kello-Bilt Industries Limited Stettler, Alberta	- subsoilers - moldboard ploughs - disk harrows - giant bale transporters - hay stack movers
Kep Industries Kerrobert, Saskatchewan	- chemical incorporators - granular chemical applicators - grain bin unloaders - harrow drawbars - sprayers

Company	Products Manufactured
Kirchner Machine Limited Lethbridge, Alberta	- land levellers - subsoilers - soil scrapers - field cultivators - irrigation ditch diggers - irrigation pipe carriers - bale feeders - bale wagons - giant bale transporters - sugar beet harvesters - sugar beet toppers
Kuelker's Manufacturing Limited Didsbury, Alberta	- forage wagons - bale feeders
Leon's Manufacturing Company Limited Yorkton, Saskatchewan	- dozer blades - land levellers - front end loaders - air seeders - rock pickers - rod weeders - spring tooth harrows
Loewen Manufacturing Company Limited Altona, Manitoba	- combine pick-ups
Mac Don Industries Limited Winnipeg, Manitoba	- windrowers - swathers
Maritime Farm Implements Limited Middleton, Nova Scotia	- subsoilers - rock windrowers and pickers - root and stump rakes - trash rakes - stone rakes - soil packers

Company	Products Manufactured
Maritime Farm Implements Limited Middleton, Nova Scotia (continued)	- fork lift forks - fertilizer and lime spreaders
McKay Ralph (Canada) Limited Regina, Saskatchewan	- harrow attachments - tillage sweeps
Monarch Industries Limited Winnipeg, Manitoba	- mixers - irrigation pumps
Morris Rod Weeder Company Limited Yorkton, Saskatchewan	- bale wagons - rod weeders - cultivators - chisel ploughs - grain drills
Ram Industries Limited Yorkton, Saskatchewan	- log splitters - rear utility tanks - self propelled skid steer loaders - loader snowblade attachment
Richardson Great Northern Manufacturing Incorporated, Winnipeg, Manitoba	- sprayers
Rite Way Manufacturing Company Limited Regina, Saskatchewan	- chisel ploughs - mulch tillage implements - spring tooth harrows - sprayer soil incorporators
Rock-O-Matic Vonda, Saskatchewan	- rock pickers - windrowers - diggers

Company	Products Manufactured
Rotoclear Manufacturing Limited Calgary, Alberta	- rotary tillers - powered stump cutters - land clearing devices - limestone crushers and pulverizers
S.E.D. Systems Limited Saskatoon, Saskatchewan	- electronic monitors
Schulte Industries Limited Englefeld, Saskatchewan	- rock pickers - rock windrowers - scrapers - snow blades and ploughs - snow-blowers
Spierco Industries Limited Calgary, Alberta	- chemical applicators - grain drill fertilizer attachments - cultivator fertilizer attachments
Uniflyte Company Limited Winnipeg, Manitoba	- auger screws
Versatile Farm Equipment Company Winnipeg, Manitoba	- tractors - combines - grain drills - windrowers - cultivators - mulch tillage implements - rod weeders - augers
Vertec Industries Limited Vermilion, Alberta	- grain dryers - sprayers - drainage pumps

Company	Products Manufactured
Western Industrial Products Division of Rockbit Company Limited Calgary, Alberta	- fertilizer storage tanks
Westfield Industries Limited Rosenort, Manitoba	- grain augers - harrows
White Line Manufacturing and Distributing Company Bowden, Alberta	- livestock and implement trailers
Wilger Industries Limited Saskatoon, Saskatchewan	- sprayers

Worldwide Component

Farm machinery is imported from various countries around the world. The following is a listing of farm machinery and related equipment imported into Canada, and Ontario, from major farm machinery manufacturing countries. This list is not based on an in-depth search and therefore, some types of machines and certain countries may have been missed. However, it is believed to be sufficiently complete to convey the message of the variety of foreign countries and machinery that makes up this particular segment of the industry.

Machinery Imported into Ontario from Major Farm Machinery Manufacturing Countries

Country of Origin	Machinery Imported
Australia	harrows, pull type combines, sprayers.
Austria	tractors, harvesting machinery, irrigation systems.
Belgium	field sprayers, cattle equipment.

Country of Origin	Machinery Imported
Denmark	field, vineyard and orchard sprayers, moldboard ploughs, field cultivators, cultivator tynes, shares, points and shovels, disc harrows, harrows, rock pickers, stone windrowers, grass seeders, mower/conditioners, forage harvesters, harvesting machinery, irrigation systems, lime and fertilizer spreaders, milking machinery, cattle equipment.
England	tractors up to 90 hp., grain drills, minimum till planters, fertilizer applicators, field and row crop cultivators, subsoilers, disc harrows, chisel ploughs, moldboard ploughs, tractor mounted sprayers, flail cutters, feed mixers, lawn aerators and rakes, potato machinery (diggers, pickers, baggers, planters).
Finland	cultivators, weeders, peat farming equipment.
France	tractors, round balers, field, orchard and vineyard sprayers, rotary tillers, mowers, apple sweepers, milking machinery, cattle equipment, poultry equipment, and irrigation systems.
Germany	hay balers, mowers, rakes, tedders, swathers, silage block cutters, tractors, planters, transplanters, combines, drag and spring tooth harrows, rotary tillers, sprayers, manure spreaders, irrigation systems, cattle equipment, milking machinery, poultry equipment.
Holland	hay mowers, rakes, tedders, conditioners, balers (large square), forage harvesters, cultivators, fertilizer spreaders, sprayers, irrigation systems, poultry equipment, milking machinery, cattle equipment, vegetable farming equipment.
Israel	irrigation systems, agricultural plastics equipment.

Country of Origin	Machinery Imported
Italy	tractors, rototillers, small sprayers, row crop cultivators, manure spreaders, harvesting machinery, cultivators, fruit and vegetable farming equipment.
Japan	tractors up to 90 hp., rototillers, cultivators, milking machinery, electronics of all types, garden equipment.
New Zealand	chisel ploughs, harrows, grain drills, grass seeders, milking machinery.
Norway	rear tractor blades, stone rakes, rock pickers, moldboard ploughs.
South Africa	disc harrows, chisel ploughs, cultivators, cultivator fertilizer attachments.
Russia	large tractors, wagons, manure spreaders, field cultivators, ploughs, combines.
Spain	tractors, hay mowers, rakes, conditioners, forage harvesters.
Sweden	chain saws, planters, milking machinery, moldboard ploughs, cattle equipment.
U.S.A.	all types of equipment, and in greater quantities than from any of the above countries.

CHAPTER FOUR

HAZARDOUSNESS RATINGS OF FARM EQUIPMENT

Farm machinery is operated and maintained by farmers and farm employees in various specialized applications within the agricultural industry. As outlined in the terms of reference in Chapter One, an attempt has been made to present a qualitative and impressionistic safety hazardousness rating, and to identify the hazards of the various pieces of farm equipment. The ratings have been assigned from the equipment design, configuration and construction point of view, as opposed to the experience and use point of view. The purpose of these ratings is to help identify those types of machines and types of farming that are most dangerous or hazardous, due to the complexities or other characteristics of the machinery used. The ratings also cover the service and maintenance characteristics of the machines.

Farm Machinery Used in Tillage, Planting, Fertilizing and Harvesting Crops

Types of Farming Disciplines

To cover the farm machinery used in working and fertilizing the soil, planting, cultivating and harvesting crops, three basic categories have been used:

1) Cash crop farming (grains).

2) Fruit and vegetable farming.

3) Tobacco farming.

Common Denominator Equipment

The equipment listed below is common to the three disciplines of farming mentioned above. These machines are used in varying sizes and configurations for each of the specialized operations.

1. Tractors
2. Ploughs.
3. Discs

4. Cultivators
5. Harrows
6. Planters
7. Wagons
8. Sprayers

Hazard Ratings

A hazard rating on a scale of 0-10 is used, with 10 being the maximum hazard. It does not mean that a "0" rated machine is perfect and that a "10" rated machine is too hazardous to use. The main factors considered in the hazard rating are:

1. Machine Complexity:

   - number of parts
   - number of moving parts
   - speed of moving parts
   - likelihood of needing a great deal of adjustment
   - exposure to danger while servicing because of the complexity of the machine
   - pinch points related to motion, mechanisms and machine function
   - need for certain skills and training in order to operate safely and satisfactorily
   - need for certain skills to maintain and service the machine
   - location of energizing stop levers, or buttons.

2. Size, physical configuration, mobility, centre of gravity and the effect of:

   - speed of operating the machine
   - transportation speed
   - visibility of operating parts at the front and rear of machine
   - visibility of other operators on the machine
   - noise level around the machine
   - provision of controls and their location on the machine
   - self-propelled or towed machine
   - shifting load such as liquids
   - presence of exposed sharp edges and cutting or shearing sections
   - presence of man size openings.

3. Service and Maintenance

- likelihood of service error
- danger in making adjustments i.e. whether the machine has to shut off for adjustments
- frequency of adjustments required e.g. a combine has more adjustments when compared to a cultivator
- frequency of service and lubrication and location of service parts on the machine.

4. The ability of the operator to make the machine hazardous through

- neglect and misuse
- ease of removal of guards
- presence of interlocking guards
- no guards at all because of the operating characteristics of the machine
- provision of tie downs, or clamping devices.

The following is a list of various implements and machines used by the three disciplines of farming with an empirical, qualitative, and impressionistic hazard rating and a brief comment on the type of potential hazard. It may be noted that this is based on the collective judgement of experienced, and presumably unbiased, individuals at the Ontario Centre for Farm Machinery and Food Processing Technology. The hazard ratings of the machines are based on the machine and machine design factors as described only; they are not based on the operator's point of view nor on the physical and mental condition of the operator.

Cash Crop (grains)

Tractors - (field) Hazard Rating - 4

Likely hazards relating to tractors include those related to tractor upsets, crushing and pinching accidents during hitching operations and getting entangled in p.t.o. shafts. The height of the centre of gravity and the lateral stability of the tractor influence the ease with which a tractor will upset in a hazardous situation. Hitching an implement above normal drawbar height can cause a tractor to overturn backwards. Although many of the new larger tractors have cabs, most tractors do not have roll over protective structures

to protect the operator when a tractor overturns. On many tractors, the operator appears to be insufficiently shielded from the rear tires.

Subsoilers — Hazard Rating - 2

The greatest hazard imposed by the machine is its weight. Like most tillage machinery, the subsoiler is often serviced in the raised position. Improper blocking or jacking of the machine, can result in having the implement or one of its components fall, which creates a hazard to the person servicing the equipment.

Ploughs — Hazard Rating - 3

The hazard which was described for the subsoiler also exists with this machine. The exposed sharp edges of the cutting coulters creater another potential hazard on the plough.

Discs — Hazard Rating - 4

Disc harrows are bulky and have exposed sharp edges. The latest disc harrows are larger in size, requiring complicated folding arrangements. The probability of these folded sections falling is minimal, but must be considered a safety hazard. These sections, when raised in a vertical position, can also hit low obstacles such as tree branches or telephone lines, or people.

Harrows — Hazard Rating - 3

Harrows have many sharp points and are generally awkward to manoeuvre because of their large size.

Cultivators - Field — Hazard Rating - 4

The newer models are quite large and heavy and require the operator to climb in among the machine components when servicing or adjusting the machine. Many of the field cultivators are folding models.

Cultivators - Row Crop — Hazard Rating - 4

The row crop cultivator has a large number of cultivator sweeps or points, which have exposed sharp edges, and are noted especially during the adjustment, maintenance and servicing of the machine.

Packers - Crumblers — Hazard Rating - 2

Some of the newer models have folding arrangements.

Planters - Corn, Beans — Hazard Rating - 4

Planters have a number of rotating and moving parts, which result in pinch points, shear points and wrap points. The planting operation requires the operator to be near the machine often, which increases the potential for injury. On many planters, the operator must climb on to a tool bar or hitch to fill the fertilizer applicators.

Grain Drills — Hazard Rating - 3

Grain drills do not have as many moving parts as planters, but the operator is subjected to the same types of hazards.

Combines — Hazard Rating - 9

A combine is a large, noisy piece of machinery with a great number of moving parts that are exposed and have sharp edges. These machines occasionally plug up, which requires the operator to place himself in vulnerable positions. There are man-size openings in combines.

The operator's visibility is very limited when driving a combine, which makes it difficult to manoeuvre around obstacles safely. They are steered by their rear wheels, making the control of the combine more difficult when travelling at road speeds.

Corn Pickers — Hazard Rating - 8

The corn picker is a slightly smaller machine compared to the combine, but is just as complicated. It has a larger number of moving parts, pinch points, and pull-in points. Corn pickers also tend to get plugged at times.

Wagons — Hazard Rating - 2

Wagons greatly obstruct the rear view of the tractor operator. Road travel is dangerous for the tractor operator, as well as all other vehicle passengers because of this lack of visibility. Tall loads travelling at excessive speeds can upset easily.

Climbing into a gravity wagon can be dangerous, because the surface on which the person must stand is usually quite slippery, as well as steeply sloped.

Water Tanks on Wagons — Hazard Rating - 3

A tank full of water travelling at road speeds carries a great deal of momentum and is subject to sudden load shifts. This makes sudden stops or turns at excessive speeds very dangerous.

Stone Windrower — Hazard Rating - 4

This machine is made of components which are quite heavy. This makes the servicing of this machine hazardous.

Stone Pickers — Hazard Rating - 4

Same as stone windrowers.

Manure Spreaders — Hazard Rating - 6

These machines have rotating sharp edges. These rotating parts result in pull-in points or wrap points.

Liquid Manure Spreaders — Hazard Rating - 4

These are usually bulky tanks without baffles to stop the shifting of the load, especially when the tank is partially full.

Agitators — Hazard Rating - 4

This unit is generally positioned on the edge of the tank or manure pit and is powered by a p.t.o. shaft. Sometimes the adjustments have to be made while standing in a precarious position.

Generators — Hazard Rating - 4

Normally driven with a p.t.o. shaft from a tractor, which is exposed. Possibility of electric shock from wires.

Pumps — Hazard Rating - 2

Possibility of leaks and liquids could be under high pressure.

Scraper Blade — Hazard Rating - 2

The scraper blade is quite heavy and has a sharp lower edge.

Fruit and Vegetable Crops

Tractors - (orchard) — Hazard Rating - 7

In an orchard, a tractor operator is subjected to many overhead obstacles, but most tractors are not equipped to offer overhead protection to the operator.

Wagons — Hazard Rating - 2

Wagons obstruct the rear vision of the tractor operator.

Harvestors — Hazard Rating - 8

The harvestors are generally bulky, noisy and allow limited visibility for the operator. They have a large number of moving parts, which mesh into pinch points, shear points and pull-in points. On many harvesters, personnel are required to be in close proximity to some of these moving parts.

Picking Aids — Hazard Rating - 4

Picking aids are basically frames that carry personnel, and often offer very few restraining devices for the riders.

Cultivators — Hazard Rating - 4

Same as Cultivators, p. 59.

Discs — Hazard Rating - 4

Same as Discs, p. 59.

Planters - Transplanters — Hazard Rating - 5

Transplanters have a number of pinch points and exposed chains. There are always persons near these moving parts, which enhance the odds for injury.

Bedders - ridgers — Hazard Rating - 3

Same as Ploughs, p. 59.

Mowers — Hazard Rating - 8

The mowers have high speed rotating blades, which has the potential of injuring a person, either by coming in contact with that person or by propelling objects at him or her.

Post-hole Diggers — Hazard Rating - 8

Post-hole diggers have the p.t.o. and the auger exposed.

Irrigators — Hazard Rating - 2

Irrigators have a few moving parts and pinch points. Some of them have the p.t.o. exposed.

Fork lifts — Hazard Rating - 4

Tne fork lift driver's vision is often obstructed by the load being transported. Load stability as well as vehicle lateral stability are potential hazards of this machine. Loads carried at elevated positions raise the fork lift's centre of gravity and increase the likelihood of vehicle upsets.

Front End Loaders — Hazard Rating - 5

Carrying loads with the bucket in an extended position can reduce the stability of the tractor. The tractor operator's vision can be obstructed by the loader bucket.

Toppers — Hazard Rating - 8

Toppers have pinch points and exposed sharp edges that are rotating rapidly.

Corn Detasselrs — Hazard Rating - 8

The hazards described for toppers also apply to corn detasselers. This machine has a very high centre of gravity which reduces its stability. The danger which results from this lack of stability is magnified at road speeds.

Crop Thinners — Hazard Rating - 3

Crop thinners have sharp cutting edges.

Land Levellers — Hazard Rating - 3

This is a very large and heavy piece of machinery. Injuries caused by these machines are most likely to occur when the machine is being serviced.

Chain Saws — Hazard Rating - 8

Chain saws have exposed sharp edges that are moving at extremely high velocities. Wood debris projected from the saw blade is another hazard for the operator.

Tobacco

Tractors - field — Hazard Rating - 4

Same as Tractors, p. 58.

Discs — Hazard Rating - 4

Same as Discs, p. 59.

Cultivators — Hazard Rating - 4

Same as Cultivators, p. 59.

Ridgers — Hazard Rating - 3

Same as Ploughs, p. 59.

Transplanters — Hazard Rating - 5

Same as Transplanters, p. 63.

Plant Pullers — Hazard Rating - 4

Plant pullers have a number of moving belts and chains resulting in several pinch points.

Tobacco Harvesters - Manual — Hazard Rating - 5

These are self-propelled machines that have a number of exposed moving parts and pinch points. The load is generally carried on top of the machine above the top leaves.

Tobacco Harvester - Automatic — Hazard Rating - 9

The safety hazards associated with this machine are similar to those described for the combine.

Trailers — Hazard Rating - 3

The heavy bins carried on these trailers are dumped out on one side of the trailer. During this procedure, the loads are shifted in one direction, causing a stability problem.

Bin Lifters — Hazard Rating - 4

The heavy load is capable of swinging, which can lead to hazardous situations. There are a number of moving linkages on bin lifters which create pinch points.

Stalk Choppers — Hazard Rating - 6

Stalk choppers have rotating sharp edges which are exposed. Projectiles thrown by these machines can also be hazardous to bystanders.

Toppers — Hazard Rating - 8

Sharp knife edges are rotating at high speeds on toppers. Objects can be propelled from the unit at very high velocities.

Irrigators — Hazard Rating - 2

Same as Irrigators, p. 64.

Deluggers — Hazard Rating - 4

Deluggers have rotating parts which create pinch points and shear points.

Rack Loaders — Hazard Rating - 5

This machine has a number of pinch points. It runs on 110V.

Steamer Humidifiers — Hazard Rating - 9

Steamer humidifiers have high temperature surfaces and are subject to leakage.

Kilns — Hazard Rating - 3

Among the components which could potentially be hazardous are the blowers and the heat exchangers.

Strippers — Hazard Rating - 4

These machines have chains and sprockets which mesh into pinching points.

Water Tanks on Wagons — Hazard Rating - 3

Same as Water Tanks on Wagons, p. 61.

Farm Machinery Used to Handle and Apply Chemicals

Current day efficient crop production systems require effective weed, insect, disease and bacterial control. This is achieved by the used of chemical, biological and mechanical methods. Chemical application machinery such as sprayers, granular applicators, and dusters have been rated for their hazardousness as follows. The hazards have been identified by considering such factors as machinery size, configuration, complexity, operating adjustments, service and maintenance.

Most chemicals are applied by use of liquid carriers under pressure and metered through a nozzle. Some of it is applied in granular form which is either broadcast or banded. There are some chemicals applied in the form of dust. The functions of chemical application equipment are to store, meter, atomize and distribute the chemical accurately to control the target diseases, pests, insects, and weeds.

Chemical fertilizers are also applied with the use of the above mentioned machinery in liquid, granular, and anhydrous forms.

Sprayers

Boom Type Skid Mounted — Hazard Rating - 4

The access to the tank opening is cumbersome.

Boom Type Tractor Mounted — Hazard Rating - 5

The p.t.o. is usually exposed and there exists the possibility of splashing from the lids. Access to the tank for filling the chemical may be cumbersome, and there is no drift control.

Boom Type Trailer Mounted — Hazard Rating - 6

Hazards are similar to those mentioned for the tractor mounted sprayers.

Boom Type High Clearance — Hazard Rating - 6

Access to tank lid for filling chemicals, and the location of the driver's seat is usually high on the machine. There are drift problems. Some large machines can spread out to a width of fifty to sixty feet, making them vulnerable to obstacles.

Mist Type/Air Blast Sprayers — Hazard Rating - 6

The extremely fine state of the chemical mixture, and the direction in which is released, encourages drift. They have high speed fans and are operated under conditions of high pressure.

Boomless Type Sprayers, Cultivator/Disc Mounted — Hazard Rating - 4

Access to tank can be cumbersome.

Knapsack Sprayers — Hazard Rating - 2

There is a possible danger of spillage.

Granular Applicators

Broadcast Spinning Disc Type — Hazard Rating - 5

Pneumatic Applicators — Hazard Rating - 5

There are rotating and moving parts, and particles are propelled away from the granular applicators.

Anhydrous Ammonia Applicators — Hazard Rating - 10

The chemical is at high pressure in the tank. There is a possibility of leakage from lines and couplers.

Dusters — Hazard Rating - 4

The machine has rotating parts which are exposed.

Side Dress Applicators — Hazard Rating - 3

There are a number of pinch points and exposed chains.

Feed and Grain Handling Equipment on the Farm

Grain and feed are an integral part of most farm operations. Grain is either stored, transferred, processed or transported, or a combination thereof, on the farm. Another major component of feed is hay and silage, which is harvested, transported, stored and distributed on the farm. The machinery used to handle feed and grain can vary from very simple set-ups and configurations to those that are elaborate and make use of new technology. In an attempt to simplify the listing of the feed and grain handling equipment, it has been categorized as transporting, handling and processing equipment.

An analysis and commentary on the hazard rating is based on the design and function of the equipment, and is presented with ratings based on the criteria explained earlier.

Equipment for Transporting Feed and Grain

Farm Truck and Tractors — Hazard Rating - 4

The trucks are usually bulky and have restricted visibility at the rear, especially for backing up to load and unload. Tractor hazards are the same as those listed on Page 58.

Gravity Wagons — Hazard Rating - 2

These wagons have man size openings and no brakes.

Self-unloading Wagons/Forage Wagons — Hazard Rating - 8

These machines have man size openings with several pinch points and exposed beaters. They are bulky and can be tipped over when being transported through rough fields and farm lanes.

Bale Wagons — Hazard Rating - 5

They carry heavy, bulky loads making them cumbersome to manoeuvre in farm yards and laneways. Visibility is limited at the rear of the wagons when they are loaded.

Equipment for Handling Feed and Grain

Power Driven Augers — Hazard Rating - 8

These have high speed rotating sharp edges, and shafts. There is a possibility of objects being projected away from the machines on to bystanders or operators.

Blowers and Throwers — Hazard Rating - 10

Very high speed sharp edged moving parts, with man size openings for intakes create a hazard. Objects can be propelled away from these machines.

Chain and Belt Elevators — Hazard Rating - 6

There are exposed moving parts with pinch points, which may be operating at relatively high speeds.

Silo Unloaders — Hazard Rating - 9

The machine normally operates in a remote location from the power switch. Components run on high voltage. The auger and teeth are exposed. The unloader unit is usually suspended inside the silo during filling. Maintenance is cumbersome, especially when the unloader is located on top of the silo.

Rakes and Tedders — Hazard Rating - 4

The p.t.o. shaft and sharp points are normally exposed on this machine.

Hay Balers — Hazard Rating - 6

The pick-up unit is exposed with moving sharp points. Pinch points and parts moving relative to each other are exposed. The large round balers have man size openings for material inlet and an exposed p.t.o shaft.

Forage Harvesters — Hazard Rating - 9

These are bulky machines, which in addition tow a forage wagon making the machine cumbersome and difficult to manoeuvre. Visibility is poor and sharp moving parts are present. The machine is quite complex with a number of parts that require regular maintenance.

Swathers — Hazard Rating - 8

Sharp edges on the cutter bar and rotating parts are exposed.

Skid Loaders — Hazard Rating - 6

There are a number of pinch points. Sometimes visibility can be a problem.

Wheelbarrows — Hazard Rating - 1

The load is unstable in transport position with possibility of causing back injury.

Feed and Grain Processing Equipment

Driers — Hazard Rating - 4

The burners, fans, and heat exchanger section are complicated, with proper operation dependent on a combination of parts working in the right sequence.

Feed Mixers — Hazard Rating - 4

There are man-size openings with rotating intermeshing parts inside.

Rollers — Hazard Rating - 4

Rollers operate at high speed creating a pull-in hazard.

Hay Processors — Hazard Rating - 6

These machines have high speed rotating shafts with sharp edges and there is a possibility of objects being propelled away from the machine.

Feed Grinders — Hazard Rating - 8

There are a number of high speed moving parts and objects can be propelled away from the machine. Sometimes driven by a p.t.o. shaft which may be exposed.

List of Machinery Categorized by Hazard Intensity	**Hazard Rating**
Anhydrous ammonia applicators	10
Blowers, throwers (silage and grain)	10
Silo unloaders	9

List of Machinery Categorized by Hazard Intensity (cont'd)	Hazard Rating
Combines (self propelled)	-
Combines (pull type)	9
Swathers	9
Harvesters, automatic tobacco	9
Steamer humidifiers	9
Harvesters, fruit and vegetable	8
Mowers	8
Forage wagons	8
Forage harvesters	8
Corn pickers	8
Grain augers (portable)	8
Post hole diggers (p.t.o. driven)	8
Toppers	8
Corn detasselers	8
Chain saws	8
Feed grinders	8
Mist type/air blast sprayers	7
Tractors (orchard)	7

List of Machinery Categorized by Hazard Intensity (cont'd)	Hazard Rating
Hay balers	6
Manure spreaders	6
Self unloading wagons	6
Chain and belt elevators	6
Skid loaders	6
Boom type trailer sprayers	6
Boom type high clearance sprayers	6
Stalk choppers	6
Front end loaders	5
Boom type tractor mounted sprayer	5
Granular fertilizer applicators (broadcast - spinning and pneumatic)	5
Bale wagons/handling equipment	5
Planter/transplanters	5
Manual harvesters - aid for harvesting tobacco and vegetable crops	5
Rack loaders (tobacco)	5
Tractors (field)	4
Cultivators (field and row crop)	4

List of Machinery Categorized by Hazard Intensity (cont'd)	Hazard Rating
Discs	4
Row crop planters	4
Rakes and tedders	4
Stone windrowers - pickers	4
Liquid manure spreaders	4
Feed mixers	4
Agitators	4
Feed rollers	4
Hay processors	4
Driers	4
Generators	4
Boomless type cultivator/disc mounted sprayers	4
Boom type skid mounted sprayers	4
Dusters	4
Picking aids	4
Fork lifts	4
Bin lifters	4
Plant pullers (tobacco)	4

List of Machinery Categorized by Hazard Intensity (cont'd)	Hazard Rating
Deluggers (tobacco)	4
Strippers (tobacco)	4
Seed drills	3
Ploughs	3
Livestock trailers	3
Bedders/ridgers	3
Land levellers	3
Water tanks on wagons	3
Crop thinner	3
Side dress applicators	3
Kiln	3
Harrows	3
Pumps	2
Gravity wagons	2
Sub soilers	2
Irrigators	2
Knapsack Sprayers	2
Packers	2

List of Machinery Categorized by Hazard Intensity (cont'd)	Hazard Rating
Scraper Blades	2
Wheelbarrows	1

CHAPTER FIVE

ORGANIZATIONS CONCERNED WITH HEALTH AND SAFETY RELATING TO FARMERS IN ONTARIO

There appears to be only one organization in Ontario whose principal concern is health and safety relating to farmers - the Farm Safety Association. The majority of the organizations that either represent the various segments of the industry, or serve the industry in some fashion, have been mentioned in Chapter Two. The organizations listed in this chapter are those that have at least partially mandated involvement in safety matters. These organizations may not be directly concerned with health and safety relating to farmers, but have an interest in their specific fields, regarding safety in the agricultural industry.

Farm Safety Association

The Farm Safety Association was founded in 1973 for the purpose of reducing the number of injuries and accidents on Ontario farms. The Association's head office is located in Guelph and is staffed by thirteen full time employees. It is sponsored by the Workers' Compensation Board (WCB) and is governed by nineteen Ontario farmers from various geographical regions of the province. It also serves more than twenty-five thousand farm employers in Ontario who pay assessments to the WCB. The FSA serves as an umbrella organization, co-ordinating and supporting the activities of twenty-seven county based Farm Safety Associations, made up primarily of farmers and farm employees, and others interested in farm safety. The operation of these twenty-seven associations is on a voluntary basis.

The principal activities of the FSA, and its sub-associations are concerned with awareness and education, relative to farm safety. In this regard, they introduce educational programmes into schools, 4-H clubs, Junior Farmer clubs, Fanshawe College (Woodstock), Sir Sanford Fleming College (Lindsay), and the five colleges of Agricultural Technology. They also have educational services for large farm employers.

The safety promotional programmes and services include safety audits, technical consulting, supervisory seminars, and employee training. The FSA will provide the above services on request by farm employers, manufacturers, and dealers.

Safety and health promotion is carried out by means of displays at various organizational trade shows, participation at local commodity meetings, and through articles in trade publications.

The Association has developed a rural Ontario safety kit programme which has been implemented by eighteen Boards of Education. By 1985, the FSA hopes that this programme will result in the exposure of approximately three hundred thousand rural elementary school children to some elements of farm and rural health safety.

In co-operation with the Junior Farmers, the FSA is sponsoring tractor safety competitions and is developing more joint programmes relating to farm machinery.

The Association is also involved with Agricrew, Junior Agriculturalist, Herdsworkers and the Farm Equipment Mechanics Course sponsored by the Ontario Ministry of Agriculture and Food. This course has been started to ensure that basic training is available for all farm workers,and is offered regularly at the University of Guelph by the School of Engineering. It may also be conducted at other locations as interest warrants.

As part of its operation, the FSA has produced a series of specialized safety films dealing with various aspects of farming. Of particular area interest is the farm machinery safety film, produced by the Ontario Ministry of Agriculture and Food for the Association, entitled, "Life and Limb".

The Association can also provide services to determine hazardousness levels of noise and formaldehyde.

Although they are not an enforcement body, the FSA willingly provides advice and information to manufacturers, relative to safety, concerning the design and manufacture of their products.

The FSA is obviously a well intentioned, informed and motivated group, but it would appear that it is not as effective as it might be in promoting safety and in influencing the majority of farm machinery manufacturers and individual farmers. This might stem from four important reasons, none of them deficiencies of the FSA.

1. The lack of a spokesperson or association representing the majority of Ontario farm machinery manufacturers prevents the FSA or anyone else from effectively communicating with this whole industry as an industry.

2. The lack of any apparent authority to ensure the adoption of safety features or safety design standards in the farm machinery manufacturing industry.

3. The apparent lack of an authority to ensure that manufacturers correct apparent safety deficiencies in their machinery designs.

4. The apparent lack of an ability to apply financial or other penalties to farmers with excessive accident frequencies. A suitable comparable reference is the case with the WCB in most manufacturing industries. In those cases, when specific company accident frequencies reach certain levels, the WCB assessment rates double, and this provides reason or incentive for such companies to addresss their safety concerns. This is not the case with farmers who have no hired workers.

In summary, the FSA is advising farmers on matters which seem to be less than that group's top priority. Further, it would seem that the FSA requires better communication with the farm machinery industry, and the farm machinery industry in turn needs encouragement and/or incentive to enhance its priority of safety in farm machinery design.

List of Organizations that have Partial Involvement Relating to Safety on the Farm

1. Canadian Farm and Industrial Equipment Institute (CFIEI)

2. Ontario Farm Machinery Board (OFMB)

3. Canada Safety Council

4. Canadian Society of Agricultural Engineers (CSAE)

5. American Society of Agricultural Engineers (ASAE)

6. Prairie Agricultural Machinery Institute (PAMI)

7. Universities, Colleges, and Government Centres

8. Ministry of Labour

9. Ontario Centre for Farm Machinery and Food Processing Technology

Canadian Farm and Industrial Equipment Institute

CFIEI has an Engineering Safety Committee, which serves as a basic source of expertise for their members concerning technically based regulations. The Safety Committee meets because of specific safety concerns regarding a specific machine or implement, and the frequency of accidents on the machine. This group is used as liaision for the individual manufacturer, when a problem is brought to their attention by the Coroner's office of Ontario or the Farm Safety Association.

The Institute has been involved in the broadcast of a series of radio taped messages on safety, and has also prepared a videotaped presentation on safety, to be broadcast throughout Canada. In association with the Farm Safety Association, member companies of the CFIEI were represented on committees to develop the Mechanics Training Programme.

Its economic impact on farmers is not direct, but rather through member manufacturers. CFIEI may recommend safety related changes in design or production techniques for a product, which may ultimately affect the cost of production and the selling price of a product. Because CFIEI represents only large manufacturers, and some major component and material suppliers, their impact on the total farm machinery industry is not as extensive as it might be.

Ontario Farm Machinery Board (OFMB)

The Ontario Farm Machinery Board acts as an intermediary body between farmers, manufacturers and dealers to resolve disputes mainly regarding warranty, performance of machinery and sometimes safety problems. Dealing with safety is not a prime objective of the Board. However, if there is a continuing problem with machinery being marketed, or on request from the Coroner's office and the Farm Safety Association, the Board will act as liaison between the concerned parties.

The functions of the Board may have an economic impact on farmers, especially if safety problems are presented by farmers or dealers, directly to the Board and subsequent recommendations to manufacturers for machine modification result in more productive

and safe machine operation. There is also the possibility that these same recommendations may result in higher cost machinery.

Canada Safety Council

The main objective of the Canada Safety Council is to promote safety, and minimize avoidable death, injury and damage to property. The Council was created in 1968 through an amalgamation of the National Safety League of Canada, the Canadian Highway Safety Council, and the Canadian Industrial Safety Association. It is a non-profit organization, governed by a Board of Directors, comprised of thirty-two individuals representing business, industrial and government sectors. The Council operates on a national scale with the head office located in Ottawa and offices in other provinces.

Public awareness programmes such as Professional Drivers Improvement courses, motorcycle training courses, and the sponsorship of Farm Safety Week are some of the activities of the Council. "Living Safety" magazine with a circulation of about three hundred thousand, is another means of promoting safety used by the Council. The majority of the members of the Council are businesses, industry, and provincial and federal government agencies.

Canadian Society of Agricultural Engineers (CSAE)

CSAE members, professionals, and researchers in the field of agricultural engineering, are directly involved in the technical design, research and development of machinery. CSAE's involvement with safety is on a limited scale and any safety-related information is communicated through technical papers, which may be relayed to the farmers through new bulletins by other organizations such as OMAF, FSA, etc.

American Society of Agricultural Engineers (ASAE)

ASAE safety and standards committees set out various standards for the design of farm machinery, but these standards, engineering practices and data are informational and advisory only. Their use in industry is entirely voluntary.

The economic impact on farmers is indirect and results from trends or practices initiated by researchers, machinery designers and developers in the industry who follow standards

set out by ASAE committees. Most ASAE publications are technically oriented, catering to the interests of professional engineers, rather than individual farmers.

Prairie Agricultural Machinery Institute (PAMI)

Programmes of evaluation, development and research are undertaken by PAMI to improve the design, and aid in the selection and use of agricultural machinery.

The evaluation programme provides farmers with information on machine performance, work rates, general acceptability and safety features. Engineering recommendations are provided to manufacturers to improve machine performance and safety. Upon request from the farming public and industry, selected machinery is evaluated annually, and the evaluations are distributed by subscription. There is an indirect economic impact on farmers through proper machinery selection, and the availability of improved machinery in the marketplace. Safety features are not enforced by PAMI, but rather are recommended to manufacturers and adopted on a voluntary basis.

Unversities, Colleges and Government Centres

These institutions and centres are engaged in basic research and development of machinery, for the advancement and improvement of machinery used in the cultural practices for the various crops grown in Ontario. Relevant information is communicated through the Ontario Ministry of Agriculture and Food (OMAF) bulletins and seminars held at colleges. Safety problems are addressed on request, or if a persistent problem exists on a widely used machine.

Ministry of Labour and the Ministry of Agriculture and Food

The Ministry of Labour has a major responsibility for the occupational health and safety of most workers in Ontario, and like the Ministry of Agriculture and Food, a concern for those who work in agriculture. A task force on the need for health and safety protection for farmers, farm workers, and their families has been set up to assess the present situation and make relevant suggestions to the government for appropriate action. It is this group which has sponsored this report.

Ontario Centre for Farm Machinery and Food Processing Technology

In the technical assistance provided for design and development of farm machinery, safety considerations are included as part of the Centre's mandate. The main objectives and functions of the Centre are described in Chapter One.

APPENDIX

During the preparation of this report, a number of interesting sources of information concerning safety were encountered. These sources are listed here, not because they provide background to this paper, but because they may be suitable references for the Ontario Task Force on Health and Safety in Agriculture.

1. Engineering a Safer Food Machine. 1980. American Society of Agricultural Engineers. Ref. #9-80.

2. Safety for Agricultural Equipment. ASAE Standard 318.7 ANSI/ASAE, S318.6/ SAE J208d.

3. Bauer Jim, May 1984, A Surprising Look at Product Liability, Implement and Tractor. Vol. 99, #7 pg. ME-22.

4. Nutter, J. W., May 1984, Designing with Product Liability in Mind. Machine Design Vol. 56, #11 pg. 57-60.

5. It's not all Sunshine and Fresh Air. Chronic Health Effects of Modern Farming Practices. April 1984, Centre for Rural Affairs, Wathill, Nebraska.

6. Safety Guide for Farming, 1984, Alberta Agriculture, AGDEX 086-6.

7. Fundamentals of Machine Operation, Agricultural Machine Safety, 1974, Deere and Company, Moline, Illinois.